IN THE

Supreme Court of the United States

OCTOBER TERM, 1942

No._____

FORD MOTOR COMPANY,
Petitioner,

vs.

THE GORDON FORM LATHE COMPANY,
Respondent.

Transcript of Record

On Petition for Writ of Certiorari to the United States Circuit Court of Appeals for the Sixth Circuit

VOLUME II.

Defendant's Record (Continued).

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No. .....

United States Circuit Court of Appeals

FOR THE SIXTH CIRCUIT.

THE GORDON FORM LATHE COMPANY,
Plaintiff-Appellant and Cross-Appellee,

vs.

FORD MOTOR COMPANY,
Defendant-Appellee and Cross-Appellant.

EQUITY No. 4564.

APPEAL FROM
THE DISTRICT COURT OF THE UNITED STATES,
EASTERN DISTRICT OF MICHIGAN,
SOUTHERN DIVISION.

TRANSCRIPT OF RECORD.

VOLUME II.

Defendant's Record (Continued).

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(269) MORRIS E. SHAWKEY was thereupon called as a witness on behalf of the Defendant, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. Your name, please? A. Morris E. Shawkey.

Q. And you live in Detroit? A. Off and on since 1910.

Q. You are employed by the Ford Motor Company, Mr. Shawkey? A. I am.

Q. How long have you been employed by the Ford Company? A. I first went with the Ford Motor Company in the spring of 1912.

Q. What are your present duties at the Ford Motor Company? A. General Foreman of the Production Department.

Q. What department are you in now? A. That is the clutch and carburetor, fuel pump.

Q. In your work at the Ford Company have you ever been assigned to any duties in Department 410, the Cam Shaft Department? A. Yes, I have.

Q. And when was that, please? **(270)** A. That was in December, 1928.

Q. What was the nature of your duty there? A. It was general trouble man, chiefly in quality.

Q. What particular type of cam shaft was being produced in that department at that time? A. The Model A cam shaft.

Q. Were you familiar with the Model T production? A. No, I was not.

Q. I don't mean cam shafts, I mean generally of the Ford Motor Company? A. Oh, in a general way, to some extent.

Q. Can you state whether or not the standards for Model A shaft were more accurate or precise than the Model T? A. Not any more than in a general way that I could say that the general quality in Model A was much higher than it was in Model T.

Q. Now, in connection with your duties in the T-410 Department, while they were producing the Model A shafts, was it any part of your duties to observe the operation of the Melling or Walcott cam lathes? A. Yes,

to some extent. I naturally when I went into the department,—I might start at the beginning.

When I went into the department they were having considerable trouble producing a quality shaft on a production basis, and it was my job to get in and find out what the troubles were in order to get a shaft of quality, as well as quantity.

Q. Do you know why you were assigned to that particular department? A. They had considerable trouble in producing enough shafts of the (271) quality to keep the assembly line running.

Q. As I understand it, the cam shaft department at that time was one of the departments whose production tended to slow down the general assembly proposition, is that right? A. That was the understanding they gave me when I went in there.

Q. Now, what did you find when you went into that department so far as the production of cams was concerned on the cam shafts? A. Our first trouble on the cams, we were getting into difficulty on finish. We required a very smooth finish and they were having considerable trouble in grinding to get that finish.

Q. Was the production of the cam part of the cam shaft held up any because of that, or did that in any way tend to hold up the production of cam shafts, I mean both the machining and grinding, and if so, just what was the nature of those difficulties, if you can recall? A. Well, we had a number of difficulties in finish. As I say, the finish on the cams were part of our troubles. We had trouble with the finish on the bearings as well, so that it was all along about the same.

Q. I am speaking, of course, in terms more of output, rather than in accuracy or quality of work. I mean was there difficulty experienced at the time in getting the required output from the grinding machines, the finish grinding machines? A. Well, we were held up naturally some by grinding. I think we had too many machines to take care of excess grinding.

We had a trouble of getting finish, and in what we call the semi-finish or rough grinding of the cams.

Q. Just what operations were performed in that department at that (272) time for bringing the cams of the

shaft from the rough size down to the finish size? A. A great many shafts would come through with excess stock for rough grinding.

We had to hold our semi-finish size fairly close in order to get a good finish and proper finish on the finished product.

A great many shafts would come through with excess stock. In fact, I have seen as much as ⅛ of an inch on cams to be ground off in finishing, rough and finish grinding.

Q. That was after the cams left the Walcott machine? A. After they came through from the Walcott, through the hardening, into the rough-grinding.

Q. Was it necessary at that time to perform a straightening operation on the cams immediately before they were put into the Walcott machines, do you know? A. Yes, it was.

Q. Were you at all familiar with the operation of the Model T cam shaft shapers? A. No, I was not.

Q. What was the standard at that time, if you can recall, in so far as the amount of stock left on the cams by the Walcott machine for the next operation? Let's see, before we go to that, you spoke of assembly finish grinding. Now I would like you to go over the operations. You have spoken of a straightening operation, and the next operation in the department, as far as the cams was concerned, was turning the cams on the Walcott machine, is that correct? A. Yes.

(273) Q. Now, then, the next operation was a semi-finish grind, is that right? A. That is referring to cams?

Q. That is referring to cams. That is all we are concerned about here. A. Then the next operation was hardening and then rough-grinding the cams.

Q. That is, a semi-finish grinding after they came from hardening? A. After they came from hardening.

Q. And after they had come off the Walcott machine? A. Yes.

Q. And then finally a finish grind, is that the idea? A. Yes.

Q. Now, how much stock, if you know, was left on the cams by the Walcott machine to be removed in the other grinding operation which came later? A. Our prints called for, as I recall, 40 thousandths. Our gauges were set for 40 thousandths, but the cams came through with

60 thousandths and from there up, but they tried to hold them about 60, because they wouldn't clean up in our rough grinding when we held them to 40 thousandths.

I remember that quite well because we had considerable trouble. They would drive for production of the machines, and in trying to get high production from the cam lathe they were neglectful of the tools.

The tool point would wear or burn off or break off and in that way we would get cams coming through, when they were rushing hard, as much as two-thirds of them would have cams, not all the cams, but cams on the shafts, would have as much as **(274)** ⅛ of an inch of stock.

Then I would go up into that section and raise merry Ned because we had too much stock to grind.

It would cause burning of the cams, it would wear our wheels, preventing us getting production on the rough grinding cam grinders.

Well, they would cut down again and try to get down to gauge size, which I would insist on, and immediately we would have trouble with cams not cleaning up, so it was a fight between trying to hold the small amount of stock to grind and their production.

Q. About what was your average daily production in that department, do you recall? A. I could hardly give you an average daily. As I recall it, it was about 2,000 a day when I went in there in December, 1928, and we reached a high of 9,000-some odd shafts in the middle of the spring.

Q. The middle of the spring of 1929? A. Of 1929, yes.

Q. Did you make any particular recommendations at that time to anyone in authority concerning the difficulties you were having? A. Yes. I felt at that time that I could add a second turning operation which would take, would tool up the shafts to grinding tolerances, within the grinding tolerances we had allowed on our print and increase the efficiency in our grinding.

I apparently sold them on that idea, for they ordered **(275)** some Melling cam lathes for that purpose.

Q. And who was foreman of the department at that particular time? A. A man by the name of Harry Klan.

Q. Do you know a man by the name of Myers, Ralph Myers? A. He came in in the late spring of 1929.

Q. So Myers was in the department during the time you were in there, too? A. Yes.

Q. And what was Myers' position in the department? A. He was general foreman.

Q. He succeeded Klan, is that the idea? A. He did.

Q. Just with whom did you take up this matter of ordering additional Melling machines; was it Myers? A. No, as I recall—

Q. (Interposing): Or Herklotz? A. As I recall, it was before—

Q. (Interposing): Myers came into the department? A. Yes. Naturally on anything like that, where there is an added expenditure and added operation, I would talk it over with a number. I talked to Harry Klan on it, and as I say, Harry Klan, I mean to say the general foreman, I think it was in Mr. Klan's time that he was in there, and if I recall right, I talked to Mr. Smith, the building superintendent.

Q. Do you know where Klan is now located? A. No, I don't.

Q. He no longer works for the company, is that the idea? A. He left the company just before Myers came into the department.

Q. Well now, did the company act upon your recommendation and buy any additional Walcott machines? **(276)** A. They did.

Q. And do you know when those machines were bought? A. No, I couldn't say as to time. They came in in the spring of 1929.

Q. Do you know whether they were ever used for this third operation? A. No, we never used them.

Q. Do you know what use they were put to, if any? A. Yes, they were used, whether they were all used, I know there was one or two of them used for turning the eccentric on the Model B cam shaft.

Q. Do you know when the Model B type of job was put into production at the Ford Company? A. In 1932.

Q. And the Model B shaft was in all respects similar to the Model A, was it not, except for the eccentric? A. Yes. Then a slight difference in the form of the shaft.

Q. Now, did you know anything about the output of the Walcott machines per hour, or is that any part of your

job? A. No, it was not really a part of my job. I naturally had to watch costs, had to figure costs along with changing operations, or in making a quality shaft I had to stay within reason, but I checked up a little more on the Walcott lathe, due to requesting more machines, for the expense, operation, and as I recall, we had a production, or figured the production, that is, we could get 400 a day from a Walcott machine during the operation as it was at that time.

Q. 400 a day? A. I mean for each operator. An operator ran two machines.

(277) Q. That was the production you figured upon getting, is that the idea? A. Yes.

Q. Do you know whether you obtained that production from those machines? A. I think they did, but I couldn't say. That was what we figured we would get day in and day out from a machine when it was in operation.

Q. And how many would that be then per machine, or how many hours did you work the machines? A. 8 hours a shift.

Q. Do you know whether you worked those machines the full eight hours of the shift, or whether they were down for lunch time, or what happened in that respect? A. Well, they were under both conditions. It depends a great deal on the amount of production they required, what was coming off the machines, how many machines were running. If they had particular trouble that was customary, if we had particular trouble on the machines, we were short of production in that particular operation, we would run them through lunch hour.

Q. Then as I understand it at the time when you went there the production was 2,000 a day and you probably did not run the machines during the lunch hour? A. I don't believe so.

Q. But when you got up to the higher production of 9,000 a day you probably then found it necessary to run the machines during lunch hour? A. That is what I mean by times we would do that.

(278) Q. Do you know whether you had any particular difficulty in maintenance of those machines, in keeping them operating? A. Not any more than what I could see when I would complain of sizes of cams, and it would always

be one of their alibis that it was caused by trouble with their machines, and keeping it in order.

We had a number of maintenance men working there and mainly working on those machines all the time.

Q. Now, were you at any time given any particular assignment by anyone at the Ford Motor Company to see what records, if any, might be available at the Ford plant in connection with this camshaft operation? A. I don't believe I just got that question.

Mr. Farley: Read it, please.

(Question read by the reporter.)

Q. Do you understand that? A. No.

Q. Well, let me put it this way! When did you first become acquainted with me and under what circumstances? A. That was last October a year ago, I believe. I was called into Mr. Smith's office, the building superintendent of the motor building, and told to report to Mr. Crawford's office to a Mr. Coulton to be assigned in looking up records and information regarding the cam operation on the Walcott lathe and whatever was required.

Q. And did you make any searches in and around the Ford plant to locate records? A. Yes.

Q. And as a part of that work you were requested, were you not, **(279)** to interview men who had particular familiarity with the camshaft department through the years? A. Yes. I was told to find what men I could, any one of whom was connected with that work and knew from personal experience what we did.

Q. I see. How long did you spend on making those investigations and surveys, a matter of several months, 2 or 3 months? A. Yes, it amounted to 2 or 3 months.

Q. Now, do you know a man by the name of Spencer Libby? A. Yes.

Q. Just who was Mr. Libby, please? A. He is a foreman of what you call the steering gear department.

Q. Do you know whether Libby was ever connected with the camshaft department? A. Only as much as he told me he was.

Q. I hand you a notebook which has been marked Exhibit L in this case and will ask you if you ever saw that before, and if so, explain what it is. A. Yes, I have.

Mr. Spohn: Now, if your Honor please, may I have a preliminary question before the witness starts to explain that?

The Master: Yes.

Mr. Spohn: When did you first see this book now handed to you, designated as Exhibit L?

A. It was in the fall, a year ago.

Mr. Spohn: The first time you saw the book was in the fall of 1938, you mean?

A. No, that would be the fall of 1937.

Mr. Spohn: Oh, the fall of 1937?

(280) A. Oh, yes.

Mr. Spohn: I object to the question as incompetent, irrelevant and immaterial, the witness having no familiarity with the book prior to the fall of 1937. That is Exhibit L, your Honor. There was examination made on it before.

Mr. Farley: I don't think any comments are required on my part to that objection, your Honor.

The Master: Where did you find this book?

A. Mr. Libby gave it to me.

Mr. Spohn: Another objection is it is completely hearsay as to this witness.

The Master: Well, I was just wondering whether it comes in the books and records exception to the hearsay rule.

Mr. Farley: I might state, if the Court please, that I am going to produce Mr. Libby as the next witness to fully identify the book. My purpose of the examination of Mr. Shawkey at this time is to show how the book was discovered, how it came into his office, and what he did with it afterwards.

Mr. Spohn: That was not the question. It was to explain what the book was.

The Master: Yes.

Mr. Spohn: That is altogether different. If counsel is limiting this question, all right.

Mr. Farley: He explains that was a book handed him by Mr. Libby. After he answers, if you want to move to strike out any part of it, you may.

The Master: Well, I will take the testimony subject to the objection and subject to identification of the record by (281) Mr. Libby, and rule upon the question of its admissibility at that time. Now, what was the answer?

(Answer read by the reporter.)

Q. The answer so far says you have seen that book before. Where did you get that book? A. From Mr. Libby.

Q. What did you do with the book after you got it? A. I took it to Mr.—our time study man, Mike Klopsic.

Q. What was your purpose in taking the book to Mr. Klopsic? A. There was found in the book a copy of the operation of the time study, and Mr. Klopsic—in my next call I took the book to him to see if we had any records of that time study at that time and if he recognized anything in this time study that was copied here. I didn't know whether I had anything of value or not.

Mr. Spohn: I move all the answer of the witness be stricken. It is based on hearsay in the first place, and an assumption of a copy of a time study record in a book with which he is not familiar.

The Master: It certainly looks like hearsay testimony to me.

Mr. Spohn: I move it be stricken.

Mr. Farley: I haven't heard anything, if your Honor please, that I would characterize as hearsay. The witness said that he took the book—will you read the answer?

(Answer read by the reporter.)

Mr. Farley: There is not any hearsay there.

Mr. Spohn: If your Honor please, he says it is a copy of a time study record. How does he know about that? I move (282) the answer be stricken.

The Master: I will withhold ruling on that objection until I hear the rest of this testimony.

Q. (By Mr. Farley): Mr. Shawkey, are you familiar with operation sheets that are in use at the Ford Motor Company? A. I am.

Q. Is there anything about the material written in that book that would in any way, with your familiarity with

those operation sheets, lead you to believe it resembles such an operation sheet of time studies? A. It is made out in such a way that it looks like a duplicate or a copy of a time study.

Q. Now, will you proceed with your answer as to what you did with the book?

Mr. Spohn: If your Honor please, I resume my objection. If the witness is present in court who prepared that exhibit, the best evidence of what that exhibit contains, or its nature, whether it is a time study, can be given by that witness, not what its similarity may be or something else. Everything he knows is hearsay.

The Master: Why don't you withdraw this witness and put Mr. Libby on the stand temporarily?

Mr. Farley: All right, I will withdraw the witness temporarily.

(Witness excused temporarily.)

Mr. Farley: Mr. Libby, will you take the stand?

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(283) Spencer W. Libby, a witness called on behalf of the Defendant, and having been first duly sworn, testified as follows:

Direct Examination by Mr. Farley.

Q. Your name, please? A. Spencer W. Libby.

Q. And you live where, Mr. Libby? A. 918 Stevens Avenue, Highland Park.

Q. You are employed by the Ford Motor Company? A. That is right.

Q. How long have you been employed by the Ford Motor Company? A. Since October 16, 1916.

Q. Until the present date? A. Until the present date, yes, sir.

Q. And what are your present duties at the Ford Motor Company? A. General Foreman of the Steering Gear and Pedal Department.

Q. Now, in your work at the Ford Company, were you ever assigned to Department T-410, the cam shaft department? A. That is the department I started in at the Ford Motor Company.

Q. And when was that? A. October 16, 1916.

Q. And at that time how was the Ford Company machining the cams of its cam shafts? A. Well, as I recall it, they had a milling operation on the cams, followed by a grinding operation. That is the operation.

* * * * *

(284) Q. (By Mr. Farley): The milling operation which you are speaking of, Mr. Libby, I show you Defendant's Exhibit 145, pages 9-10, from the American Machinist, of July 3, 1913, and this is entitled, "Ford Cam Shaft Milling Methods." This Exhibit 145 was introduced during the trial before Judge Tuttle, and I call your attention to the showings of Fig. 3 on page 10. You hadn't seen that particular publication before, I don't think, but will you examine that Fig. 3 and state whether or not that is the milling operation you were referring to? A. Well, it looks similar. I couldn't positively say at that time.

Q. That particular milling operation was one in which you used but 3 shafts? A. 3 cutters and 3 shafts.

Q. And what was next used by the Ford Company after that? Let me put the question this way: How long did you stay in the cam shaft department from 1916, how long were you there? A. Well, I just don't recall the exact date, because whatever time they went on War work, I know I was transferred from the cam shafts up to the War work, on the Liberty motor cylinders.

(285) Q. Did the Ford Motor Company throughout your period of experience in the cam shaft department continue to use the milling operations such as shown? A. No, sir; they did not.

Q. What did they use after they discontinued the use of the milling machines? A. Ford shapers.

Q. Ford cam shaft shapers? A. Yes, sir.

Q. At the time they were using the Ford cam shaft shaper what was your duty in the department, or what was your job? A. I was assistant to the general foreman. In other words, he was the direct supervisor over that department. I had one shift under him, one of the three shifts that were under him.

Q. And in your job in having charge of one of the shifts, was it a part of your duty to know all of the operations that were performed in the department? A. Yes, sir.

Q. And was it part of your duties to know the times required for the various operations? A. That was absolutely necessary.

* * * * *

(286) Q. (By Mr. Farley): Will you please tell, what operation, if you remember, Mr. Libby, was done upon the cam shafts prior, immediately prior to the shaping operation? A. Yes. I can recall it was turned, front and rear bearings.

Mr. Spohn: Slowly. I want to copy that.

Q. Now, I show you a book, Mr. Libby, which was marked for identification here as Exhibit L, and ask you if you know what that is? A. Yes, sir; I do know what that is.

Q. Will you please tell the Court what it is? A. Well, sir, this part here—

Q. First, generally what the book is. A. The book was the property of myself when I was in the department 410, and I kept various records from time to time, always having the time study at my finger tips. That was necessary for any person running a job.

Q. Did the Ford Motor Company when you were foreman of the department have time studies that were made by time study men who **(287)** checked the time of the jobs? A. Oh, yes, sir.

Q. Now, will you state to the Court what memorandums, if any, are in that book? A. There are several memorandums in that book. The one here—

Mr. Spohn: I wonder if his Honor has a copy of that? I might give you the photostat, if you care to see it, your Honor.

Q. Will you refer to the page that is marked Exhibit L-1 and state to the Court what that is? A. I didn't quite get that, Mr. Farley, if you please.

Q. Will you refer to the page that is marked Exhibit L-1 and tell what the various notations and figures on that page are? A. That was a duplicate of the time study on that particular part.

Q. And in whose handwriting is that? A. That is in my handwriting.

Q. And where did you get the data or information that is contained on that page? A. I copied this from the time study.

Q. And the time study, where did you get the time study; what was the practice with respect to time studies? A. Well, there is a book left in each department of the time. It is in a folder there. It is in there and the foreman has access to it to find out various items at different times.

Q. And the figures which you put in your book, were they copied at that time, do you recall whether they were copied from a time study? A. Oh, yes, they were copied from a time study, I am positive of **(288)** that.

Q. Now, will you refer to your book there and to the operation 12, the number 12. Will you read that notation, just what you have in the book. A. "Shape Cams."

Q. "12," Shape Cams. A. .120.

Q. What does the .120 mean? A. Why, that means the time established by the time study on that particular operation.

Q. What machine, to the operation of what machine does that refer? A. That refers to the cam shapers.

Q. That were used at that time at the Ford Motor Company? A. Yes.

Q. Now, let me ask you as to the operations that are numbered here. Just what do they represent? Do they represent all or only part of the operations that were required in that department to machine a completed camshaft? A. A, B, C, D.

Q. Where were those operations performed? A. I do not know that.

Q. That is, you do not know what? A. Where those operations were performed, because this was not in my department at that time.

Q. From your own personal observation you never saw those operations? A. No, sir; they were never there, and also operations 1 and 2.

Q. Now, as to the operations that were performed in your department, **(289)** will you please refer to those? A. They begin at No. 3. "Center both ends."

Q. Now, the next operation. Just glance over those operations. A. "Center both ends." Then you put the shaft in an arbor press and you rough-straightened it.

Q. Then the next operation? A. Rough turn center bearing.

Mr. Spohn: Will you read the number, Mr. Libby?

A. Yes, sir; that was operation—center both ends was 3. Rough straighten is 4. Rough turn center bearing was 5.

Q. Go ahead, please. A. Sir?

Q. Continue, please. A. No. 6 was between the cams.

Q. Rough turn between cams? A. Yes. No. 7 was straddle.

Q. No. 8? A. Was turn the gear post.

Q. Now, your notebook just simply says gear post? A. That was just an abbreviation that I entered.

Q. Your notebook for No. 9 says what? A. Drill L hole.

Q. Your notebook says "L hole"? A. Yes. I will repeat exactly the book.

Q. The next one is what? A. End bearings.

Q. What does that notation mean? A. The front end bearing.

(290) Q. I mean what was the operation. A. On a lathe.

Q. A turning operation? A. Yes, sir.

Q. All right. Now, the next one. A. Rough grind center bearing.

Q. And the next is what? A. Shape cams.

Mr. Spohn: What is that number?

The Master: No. 12.

A. Shape cams is No. 12, sir.

Q. How do the notations in the notebook jibe with your recollection of the particular operations that were performed in that department? A. That is the same. I have the same recollection as that.

Q. You have a present personal recollection of all those operations having been performed? A. Yes.

Q. Without referring to the book, awhile ago when you had not referred to the book you said that the operation immediately preceding the operation of shaping the cams was turning the end and center bearings.

Mr. Spohn: The witness didn't say that.

Mr. Farley: All right, read back and see what he did say. That is my recollection.

Mr. Spohn: My recollection is different.

Mr. Farley: I don't think it matters.

(Answer read as follows: "Yes, I can recall it was turning **(291)** front and rear bearings.")

Mr. Farley: Turn front and rear bearings. You made a notation and I didn't.

Mr. Spohn: Failing accuracy of memories.

Q. Now, after having consulted the book, what is your recollection on that, or just what do you mean by you turned front and rear bearings? Which operation is that on your book? A. In the book?

Q. Yes. A. All I have in here on No. 10 is end bearings. That is the same thing, of course, end bearings.

Q. Now, I will ask you again what operation now then was performed immediately prior to the shaping of the cams in the camshaft shaper? A. Rough grind center bearing.

Q. Was any operation performed intermediate the rough grinding of the center bearings, or between the time that the center bearings were performed and the cams were shaped in the shaper? A. Were there any operations between those two?

Q. Yes. A. No, sir.

Q. Will you state how many operations all told are listed on these pages of the book to which you have been referring? A. How many operations are listed?

Q. Yes. You referred first to the page which is marked Exhibit L-1. A. Yes.

Q. And that contains a number of operations, beginning with A, **(292)** running from A to D, and then beginning with 1 and running down to 19. Now, will you refer to the next page of the book and that contains operations running from 20 to 42. A. That is on the next page only.

Q. Yes. A. Yes, sir.

Q. And will you glance over the operations on that page without taking time to read them all into the record, and state what those operations, or just what those notations are supposed to represent? A. All right. I will have to continue from operation 13, is that right?

Q. Yes. Let me, in order to shorten this, the operations that are listed in this list are what? A. 13 was cyanide.

Q. Yes. A. Then polish cam, re-sink and remove cyanide from holes.

Q. Now, let me ask you, Mr. Libby, so that we won't take the time to read them all, are these other operations which are given certain numbers and running from operation 13, continuing to 19 on the bottom of the page, and beginning with 20 on the next page there and running to 42, and then on the third succeeding page running to 43 to 45, were they all, rather, do they refer to operations that were performed in your department? A. Yes, sir. This here was entirely what was performed in my department.

Q. Is that a complete record of all of the operations that were required in Department 410 for the fabricating of the cam shafts? **(293)** A. That was all on the camshafts.

Q. Yes. And all those operations were performed on the camshafts in the department under your supervision as foreman, is that correct? A. With the exception of the first A, B, C, D, 1 and 2.

Q. All right. And do those notations conform with your present personal memory of the operations as performed in that department? A. Yes, sir; they refresh my memory and they bring the job back to me. It is so long ago I can't remember everything in detail without looking at this book, but when I do it comes back to me.

Q. Very well. Now, these particular pages to which we have been referring, do they have any date on them? A. These particular pages have no date.

Q. Can you state just when you made that list in your notebook; have you any way of establishing the date or approximately the date when you made that compilation? A. This was made, whatever it was, was previous to any changes made in operation. That is, when we were doing that operation. There was nothing else in the camshaft department at that time to do it.

Mr. Spohn: Just a minute, Mr. Farley. Will you read the question and answer?

(Question and answer read by the reporter.)

Q. Are there any other dates in the book, Mr. Libby, that would help you to establish the date when you made that list?

Mr. Spohn: If your Honor please, I submit that the witness has answered the question with respect to those two **(294)** pages.

The Master: I will allow counsel to further try to bring out his memory on that point. I will overrule the objection. Read back the question.

(Question read by the reporter.)

A. Well, here when these specials were made.

Q. You are referring to a page of the book which is marked Exhibit L-2? A. That is right.

Q. All right. Proceed. A. This date here, was made on the 4th, 1924, 2nd, 3rd—I can't say whether that is the 4th or 6th.

The Master: 4-4-24.

Q. Now, in whose handwriting are the notations on the page specials? A. They are mine.

Q. Is that in your handwriting? A. Yes.

Q. Those dates appearing there, 4-1-1924, 4-2-1924, 4-3-1924, 4-4-1924, did you put them in? A. I did.

Q. Were they put in at the particular date indicated, or some later date? A. What do you mean, were these put in?

Q. Yes. A. These were put in at the date indicated on that page.

Q. Can you state whether or not the compilation on the pages which are identified by the Exhibit No. L-1, whether those compilations were made before or after, or when they were made **(295)** with respect to those other dates, if you know? A. That I couldn't say. I couldn't say whether they were made before or after, but it must have been in that period, because I don't keep a book that long.

Q. Well, what would be your testimony as to whether those notations on pages L-1 were made in any of the years 1919, 1920, 1923, 1924, 1925, or what year? A. They were made in 1923 or 1924, that is, within the period of 12 months, I would say.

Mr. Farley: I offer the book and the pages thereof as Exhibit L-1 in evidence, and Exhibit L-2. There is a page here which was marked for identification as exhibit, apparently, L-3. This was Exhibit L and then Exhibit L-1 and Exhibit L-2. The whole book is L. I would suggest that the reporter mark the back of the page L-1 and the succeeding page also as Exhibit L-1, because they are all of the pages.

Mr. Spohn: If your Honor please, I object to the receipt of the document in evidence, and ask the right to cross examine the witness before you make a ruling on my objection.

The Master: Go ahead.

Cross Examination by Mr. Spohn.

Q. How old are you, Mr. Libby? A. How old am I?

Q. Yes. A. I was 48 the 24th of last November.

(296) Q. So when you came to the Ford plant then in 1916 you were— A. (Interposing): 27 years of age.

Q. You were 27 years of age? A. Just about that.

Q. What were your duties in the cam shaft department? A. When I first came in?

Q. When you came to the Ford plant in 1916. A. I was hired there and went to work on a Lo-swing lathe.

Q. How long did you work on that lathe? A. Not very long.

Q. Was it a month or a year? A. It was not very many weeks.

Q. And that was in October of 1916? A. That is right.

Q. Then what did you do after you got off working on that lathe? A. I was put machine-setting.

Q. Machine-setting? A. Yes.

Q. And how long did you work there, approximately? A. I want to give you something definite, if I can, on that. Maybe five or six months. It was not very long, anyway.

Q. Some time until 1917? A. Yes, it was early in 1917.

Q. Was it before or after the War started? A. Before the War.

Q. Before the War. And then what did you do after you got off of that job? A. Well, after I got off that job I had a section as a foreman.

Q. And where was that section? **(297)** A. The section as a foreman was on the—well, it was half hard end of the cam shaft and half of the soft end, what we call the soft end was before the part was hardened.

Q. And you were a foreman on that work? A. Foreman under the shift foreman at that time, yes.

Mr. Farley: Did you say under the soft end or under the hard end?

A. Half of each. I had the hard bearing grinding and part of the soft, because it was split in sections. The shift foreman has probably 4 foremen, 5 foremen under him on a shift at that time.

Q. How many men did you have under you? A. About 30 at that time.

Q. At that time? A. Yes.

Q. You were the foreman on the job? A. On that particular part, not on all the camshafts.

Q. And that job had something with respect to the grinding of the camshaft, you say? A. No.

Q. What did it have to do? A. The bearing, not the cams, the bearing. I ground the rear bearing and center bearing.

Q. But the rear bearing and center bearing were on the camshaft? A. Yes.

Q. How long were you foreman on that job? A. Well, sir, I was there until the War started, and then I got transferred on the War job.

Q. The War started in April, 1917, and your testimony is as soon as **(298)** the War started you got on that job? A. Yes.

Q. What was that War job? A. Liberty motor cylinders.

Q. Where was that job done? A. In the W building, W-2.

Q. The Liberty building? A. W, the letter "W."

Q. Mr. Libby, we are not quite as familiar with these buildings as you are. When you say "W-2," is that what you said? A. I had reference to W-2, the 2nd floor of the W building.

Q. Where is that located? A. On Manchester Avenue.

Q. In the City of Detroit? A. Highland Park.

Q. Were the Liberty motors built for the Ford Motor Company? A. I don't know. I was working on that one particular part.

Q. That part was what? A. Liberty motor cylinder.

Q. How long were you on that? A. Until Armistice Day.

Q. Then where did you go? A. Back to the cam shaft.

Q. What duty did you have then in the cam shaft department? A. I was a shift foreman directly under the general foreman.

Q. Who was the general foreman at that time? A. Alex McAlipine.

Q. And you were under him as a shift foreman? **(299)** A. Yes, there was three of us, one on each shift. I was one of them.

Q. How long did you stay on that job as foreman? A. On that job, I stayed there until the early part, that is, in Highland Park, if you refer to now that time, all with the Ford Motor Company in that particular department.

Q. In that department where you did the job? A. Regardless of where the job was done?

Q. Yes. A. Either May or June, 1925.

Q. Then where did you go? A. From there I went back to Highland Park on the Australian gas tank.

Q. What were your duties between the time of the Armistice and 1925 in that department? A. The same as I told you before. I was a shift foreman.

Q. You were a foreman on one particular shift? A. Yes.

Q. And that was what, an 8-hour day? A. 8 hours a day.

Q. You did that job all the way through until 1925? A. That is right.

Q. And you made your reports, did you, to your immediate superior? A. What reports have you reference to?

Q. Any reports you made, if you made any. A. There was nothing to make after the time sheets were made out, and any trouble, of course, we took that up with the general foreman.

(300) Q. But the department had a general foreman in it? A. Yes, sir.

Q. And you were working right under him? A. That is right.

Q. Your testimony is these operations set forth on Exhibit L-1 were copied by you from some sort of time study report? A. That is right.

Q. Have you got that time study report now? A. No, I haven't got it now.

Q. How often did you get time study reports? A. How often?

Q. Yes. A. You can request a time study report any time.

Q. Beg pardon? A. There is no set time for time study.

Q. I did not ask you that. I asked you how often you got them? A. As often as we requested them.

Q. Did you have the duty of requesting them? A. We did.

Q. I mean you. A. I did. When I was on the day shift if I wanted a time study on a particular job I could get it.

Q. How often did you request them? A. Well, that is hard to say, because sometimes you could run along for maybe three or four months, and if there is an operation change we immediately call the time study to get a new cost for the part.

Q. Is that the only time you called for a time study, is when you had an operation change? **(301)** A. Is that the only time?

Q. Yes. A. If I wanted to change something done on the job I would get a time study change. You might change a certain operation, or get a new machine, and then you would get the approximate time on that.

Q. Well then, there wouldn't be a time study unless there was something in the department that warranted a time study, a change of some sort or other in the operation, is that it? A. No, I wouldn't say that. What method the company has in the time department for changing their time study, or how the period is between the job, I don't know definitely, that is what I mean to say. There is a certain lapse of time. That may be five months, or six months, or maybe two months, but they have to bring the records up to date. The operation sheets are not allowed to get too old.

Q. The company determined that and not you? A. Not me. I wouldn't determine any time study. That is entirely out of our department.

Q. Did you have any duty as to whether you would have a time study or not? A. Whether I would have?

Q. Yes. A. If the operation was changed we sent in a request to change the time study.

Q. Will you look over these operations as they are set forth in Exhibit L-1 here? And indicate what change in operation was in there that required a time study. A. What change of operation was in here that required a time study?

(302) Q. Yes. A. At this time on this part?

Q. Yes. A. There is nothing. That represents, that part, that is supposed to represent—

Q. (Interrupting): There was no changed operation that was set forth on Exhibit L-1 that required any time study? A. There is no change at this time the way that part was manufactured. That there was copied from the original time study. When it was taken, I don't know.

Q. Now then, I want to be perfectly fair with you. You don't know the day upon which that time study was taken, do you? A. The day?

Q. Yes. A. The date I don't know, the date the study was taken, because time studies change so much from either a month or week or year or anything. I don't know that. But I do know that that was the operation on that cam shaft or part we were doing at that time.

Q. Now, Mr. Libby, will you look at these specials, Exhibit L-2? A. Yes.

Q. What do those specials mean? A. Well, sir, those specials, center front, rear and long—if you have a cam shaft print I could very readily show you what they represent. It is hard to explain that unless you have that. When a bearing was ground—

Mr. Farley: Before you proceed, Mr. Libby, I would like to say I am showing you print T-410 which is attached to Exhibit A and identified as Exhibit 1. Now, go ahead, please.

A. Now, if this bearing should come half a thousandth under-size **(303)** in regular manufacturing that was thrown out by the inspection department.

Mr. Farley: Excuse me a minute, please. In order that this will be in the record, when you said "this bearing" you were referring to the bearing shown in the blue-print at the left-hand side of the sheet.

A. I call it rear bearing.

Mr. Farley: And that is the rear bearing. Go ahead, please. Try to avoid saying "this."

The Master: When you refer to something, make a reference to it.

A. Center bearing. If that was ground half a thousandth under-size, why they would grind that down ten-thousandths and make a special. That is what they determine by the word "special," whatever bearing is there. That was 14 under-size bearings that day, and over here you got on the center and rear. That is what you have, and the long, the special bearing for length. This front bearing is a little too long for the regular standard part, so what we did, we took ten-thousandths off of here and made that for a special length bearing, instead of scrapping the part. That is what I mean by that part there.

Mr. Spohn: I will ask the reporter to mark a page of this book Exhibit L-3.

(The page above-referred to was marked Exhibit L-3.)

Q. I show you a page of your book marked Exhibit L-3. That exhibit has some red crayon on it and I will ask you who wrote that? **(304)** A. My little boy.

Q. Was this book at home? A. Always at home except when I worked at the Ford Company, and then I used to carry it on my person.

Q. There is a little of the writing in here that isn't yours. A. I will have to identify it if it is not mine.

Q. Did you always copy these time study records into a book? A. When a man runs a department, how otherwise is he going to base production? You have got to have something to start with. You couldn't go in there without knowledge of something. That is the first thing I do when I go in a new department. The first thing I do is get the operation sheet and get costs and see if there is anything we can improve on the job.

Q. Was this copy put in this book then at the time that you went on that job for the purpose of improving the production? A. When I went on the job?

Q. Yes. A. What particular job have you reference to?

Q. I don't know. You say these are put in the book so as to enable you to improve the work when you go into a department? A. Not necessarily.

Q. Why were they written in the book then? A. Well, I told you when I was on a job I always took the time study there and I took the operation sheets and it doesn't make any difference whether it is this week or next week, but when I first went in there I never had any access to these records.

Q. You didn't? **(305)** A. Oh, no, sir, an operator.

Q. When did you first have access to the time study records with reference to the cam shaft department? A. It was after the War.

Q. How long after the War? A. Definitely I can't say. It was after the War, I know that. I couldn't exactly remember the date.

Q. Your testimony was you came back to the Ford cam shaft as a shift foreman in 1919 after the Armistice? A. The Armistice was in 1918, wasn't it?

Q. 1918. A. Yes, I did come back after that.

Q. Were those records available to you then? A. They were.

Q. This is the only one of those time studies you put in a book like this? A. I don't remember. I found this in the attic.

Q. You found this in the attic in your home? A. In my home.

Q. Now, you state those time studies were available to you after 1918 when you were a shift foreman. A. As a shift foreman, yes, sir.

Q. What did you do with those time studies after you got them? What did you do with the papers or photostats, or whatever it was? A. They were kept in a file right there. We weren't allowed to remove them from the desk.

Q. Whose desk were they on? A. Our desk.

(306) Q. Your own desk? A. Yes.

Q. Were they always there? A. They were always there.

Q. For how long? A. Until they were changed. Then they were returned to the time study department and replaced by new ones which they had written.

Q. Well, you had available always at the plant this time study record on your desk, didn't you? A. Yes.

Q. Why did you copy it in the book, then? A. Why?

Q. Why did you copy it in this book, Exhibit L? A. On the day shift, when the day shift went home they were put away with the rest of the records of the men. That is what I mean to say, the time sheets, and when the timekeeper was gone they were put away. If you were on nights you had no access to them and you kept it in your own pocket.

Q. You were on the day shift? A. Sometimes, and sometimes on No. 3. 2 weeks days, 2 weeks afternoons, and 2 weeks midnights.

Q. Then they were not on your desk, were they? A. I said our desk, if you remember.

Q. How many men used that desk, Mr. Libby? A. The general foreman, the three shift foremen and the timekeepers.

Q. Did you make a copy of every time study that you had? A. That is the only one we had. There was only one part in that **(307)** department.

Q. Did you make a copy of every time study that was put on that desk? A. I don't remember whether I did or not.

Q. Did you ever make any other copies that you know of? A. In various departments I make them all the time.

Q. In various departments. What do you mean by various departments? A. The different departments I have been in. If I went in a new department I made it.

Q. Your testimony is when you went into a new department you made a copy of the time study? A. I always find out the time study.

Q. You did make a copy of the time study. You testified, did you not, that when you went into a new department you always made a copy of the time study? A. I

always made a copy and found out the production and everything on that job.

Q. Then thereafter you had available to you, did you, the regular time study records? A. I had it before. I couldn't make a record of it. I must copy it from something. I can't surmise that. I must prove to show I have it there. I can't go and time a job, because I am not that efficient in time study. I don't carry any stop-watch with me.

Q. And after you went into the department and after you made the copy of the first time study so that you knew the operation and time in those operations, your testimony is then you always **(308)** had, there was always submitted to you or your superiors time studies at intervals, that is right, isn't it? A. There were time studies at intervals, and when the time study was made at intervals the old ones were taken over by the time study department and the new ones placed on the desk.

Q. Have you any other book or paper or memorandum that shows— A. (Interrupting): I looked through everything.

Q. Have you any other book, paper or memorandum in which you did copy any other time study record? A. No, not in my possession I haven't right now. I can tell you the cost of every part that is made in my present department, which is over 198 pieces. I keep a minute cost of that every month, and the time study of that every month.

Q. Now, tell me again, just why did you copy down this time study in this book Exhibit L-1? A. Why did I copy it?

Q. Yes. A. Well, the reason I copied it was I couldn't go into a department and not know how much the thing cost. I always copy that for reference. It is natural that a man going into a place would find out what the part he is making would cost.

Q. Do we understand each other when you say you go into the place, you mean when you go in for the first time into the department, or what? A. No, when you go into a department, when you are transferred, in other words, to another department, it is essential that a man should know the cost of the part which he is making.

Q. And do I understand then this statement was written, this time **(309)** study was written in Exhibit L-1 when you were transferred to that department? A. It doesn't necessarily mean that.

Q. It may mean that? A. I don't say it does.

Q. It may mean that? A. It may not mean it, too.

Q. You don't know when this was written, do you? A. I know it was written previous to April, 1924.

Q. How do you know that? A. Because the date is in the book.

Q. It is on the next page? A. That doesn't make any difference.

Q. You mean to be understood as testifying here today that you can state that that information set forth on Exhibit L-1 was written in April of 1924? A. No, I can't say that.

Q. You say it was previous to April of 1924? A. I never keep a book over a year, as I already testified, and the exact date of that part, I am telling you, all that what I have written in there, I can not exactly tell the date. I couldn't tell that to save my soul. I can't remember that long ago.

Q. It may have been 1923, 1924 or 1922? A. It was in the period of a year when that book was written.

Q. Either prior to or subsequent to April, 1924? A. It was within the lapse of a year.

Q. A year either way? A. Either way.

(310) Q. Oh, either way. All right. A. I can't testify exactly right to the date when that was written.

Mr. Spohn: If your Honor please, may we have a ten-minute recess?

The Master: All right.

Mr. Spohn: And I ask this witness still be segregated from the other witnesses.

The Master: He can remain in this room, then. We will recess.

(A short recess was taken.)

Mr. Spohn: That is all, Mr. Libby.

Now, if your Honor please, I renew my objection to the offer.

The Master: Well, this document is not, of course, the primary record kept by the Ford Motor Company

of the time it takes to perform these operations, and it is not a direct study by the witness himself, because the witness testified that he was not, or did not make any time studies, and could not make them, and it is merely a copy, but I think it is sufficiently proved it was made at the time of existing time studies. It is in the nature of secondary evidence.

The only question in my mind is as to whether sufficient foundation has been laid for the introduction of this by showing that the primary records are legitimately not available.

Do you have any argument to make on that?

Mr. Farley: Yes, there is another point in connection with it. This is a record made at the time by a man familiar with the operations.

* * * * *

(311) RE-DIRECT EXAMINATION by Mr. Farley.

Q. Mr. Libby, will you refer to your notebook again, and I call your attention particularly to the operation 12, "shape cams," and for which in the right-hand column of the book you have the notation 1.20. What does that notation 1.20 mean? A. That is the time it takes.

Q. That represents then— A. (Interrupting): That operation. That is the time it takes to do that particular operation.

Q. That represents one and twenty one-hundredths of a minute, is that correct? A. That is right.

Q. And what is that, is that man-hour time for the job or machine-hour time? A. Well, by that I don't understand, but I will explain to you what I mean. That means the man takes the part and puts it in the machine and out, and that is the operation you charge the time of one minute and twenty one-hundredths.

Q. To each shaft for the time of a man on each shaft, is that the idea? **(312)** A. That is right.

Q. How many shapers would the men operate at that time? A. Shapers?

Q. Yes. A. Two.

Q. One man operated two shapers? A. One man operated two.

Q. Now, was it any part of your job to check and see whether the men were producing production, getting out

production in accordance with the time schedule as given in that notebook of yours? A. Well, here is the way we did that. I don't know how the time study do their job. That is a different thing, but what we do, we have a department, and we will say about 6 foremen in the department.

Well, as soon as one foreman got ten operations, another foreman got ten operations, and we add those operations up at the end of a day, and the time sheet will show so many men on that particular job.

Then we go to work and add these men up and the hours up and how much production we got out on that particular part, and figure the cost of each unit on a job, and the whole department is figured in after by the timekeeper.

Q. Do you use the operation sheets to check on that production? A. No, not that way.

Q. Well, now, what is your personal recollection concerning the output from the shapers and the shafts that you expected to get from an operator for each shift? A. How many shafts one man produces on 2 machines, is that what (313) you mean?

Q. That is on the regular shift. A. Around 450 to 480.

Q. Now, let me ask you this: During your period of time in the cam shaft department, as foreman of that department, from 1918 on and during the time the department was using the shapers, did you, or were there any changes in that operation of rough machining the cams that would require any new time study to be made for that particular operation, so far as you can remember? Do you understand what I mean? A. No.

Mr. Farley: Read the question.

(Question read by the reporter.)

A. There was other machines came in there.

Q. I am speaking now, the question is limited to the time when you were using the shapers, just during the shaper operation. A. The shapers is all we had to do it with right there and then.

Q. Was it required at any time, to your knowledge, to have any new time studies made on the shaper operation? A. I don't remember of any, Mr. Farley.

Q. Now, if you take the time given for that particular operation 1.20 and divide that into 60 minutes, how many —what would that give you as the output per man? A. 1.20. That would give you 50 an hour.

Q. How does that jibe with your recollection as to the output that you got from those machines? A. How does that what?

Q. How does that check up with your own personal recollection of the output? If you got 50 per hour, how many would you get **(314)** from the machine per man per day? A. That would be 400.

Q. And your recollection is you got slightly more. You testified you got more. A. Yes, we did.

Q. Now, just one more question. The counsel for plaintiff pressed you very hard to have you state that this particular record of yours was made at some other time than the date you testified. What is your best recollection, without pinning it down to any special day, as to the year when you believe you made this notation?

Mr. Spohn: If your Honor please, I submit that question has been answered by the witness.

Mr. Farley: Yes, he already has answered it.

The Master: I will overrule the objection.

A. The exact date I couldn't honestly say, because it was in a period of around a year either way. I can't exactly tell what date it was. I can't tell that.

Q. What would be your best judgment, was it made in 1923, 1924, or 1925?

Mr. Spohn: If your Honor please, I submit that counsel is cross examining his own witness. This is on re-direct examination and the witness testified with respect to the possibility of dates.

The Master: Well, he started in and asked a general question in the first place and a further specific question and then there was the cross examination, and I think counsel is entitled to go into it more specifically on re-direct. I will **(315)** overrule the objection.

A. I am positive it was not made in 1925. I am positive of that. I am positive only it was not made in 1925.

Q. How about either of the other years? What would you say as to 1923 or 1924? A. It must have been made in

1923 or 1924, in the period of a year there. I know it was not made in 1925, I know that.

Mr. Farley: That is all.

Now, with respect to the objection, if your Honor please—

Mr. Spohn: Just a few more questions on cross examination.

Re-Cross Examination by Mr. Spohn.

Q. Now, you stated to me that it might have been a year either way, you didn't know. A. I didn't know.

Q. And now you state you know positively it was not in 1925. A. I do know positively, and another thing, I went to the Rouge in 1925 and that book was made at Highland Park. We never had a book of that kind delivered to us at the Rouge plant.

Q. When you said it was a year either way, what did you mean? A. 1923 or 1924. It was possibly made in early 1923 or late 1924, but not 1925, sir.

Q. The only date that you have to fix that on is when you went to the Rouge plant in 1925? A. I went to the Rouge plant some date in September, 1924. The exact date I can't tell.

Q. What were your duties in the Rouge plant? A. When I went to the Rouge plant?

(316) Q. Yes. A. Well, I had the wrist pin, part of the camshaft and push-rod job.

Q. What part of the camshaft work did you have in the Rouge plant? A. Well, I had the hard end or the push-rod job. I can't remember the part number of that, 419, if I remember that, and the wrist pin job. I was not there very long. My wife was taken sick and I went back to Highland Park.

Q. You went back to Highland Park? A. That is when my wife was taken sick.

Q. When you say at the end of the day you figured up time records and production records and so forth, that record was not made in connection with the time sheet? A. It couldn't be here, because the first five operations I never saw in my life. That is the reason I am positive it was copied off a time study. I don't know what building they were made in.

Q. Did I understand you correctly when you said there was no change in shaper operations with respect to rough-turning while you were in that department that would require a new time study? A. Not that I know of, sir. I don't know of any operation change in there that would be required on this particular one.

Q. That would require a new time study? A. I don't know of any.

Q. Were there any other operation changes in that department while you were in it which would require a different time study, any other operations? A. Not that I know of.

Q. Not that you know of. **(317)** A. Not that I know of. I don't remember of any.

Q. In the operations with respect to that camshaft from the time you were there in 1918 until you left in 1924, they were just about the same? A. The operations were just about the same.

Q. Wouldn't require any new time study at all? A. That would be up to the time study department. That wouldn't be up to us, unless we made a radical change. If we improved our job and cut the cost we would have to report it to the time study department and they would make a check, but I don't remember anything of that kind being done.

Q. If it had happened you would probably remember? A. Yes, I would remember if there was anything that was of any great importance.

Q. You would remember that? A. Yes.

Q. You can't recall of any? A. I can't recall of any on that particular job.

The Master: You state the time study department made time studies at regular intervals whether there was a radical change or not?

A. Yes, sir; they do that. They come down and make a time study if they have got an idea there is some confliction in the cost, I suppose, they come in sometimes and time your job, take a time study, that you don't even call them in on.

If you will notice on the bottom of each operation sheet there it says that any change in operation must immedi-

ately be reported to the time study department. You see that on the bottom of the operation sheet.

(318) Mr. Spohn: I guess that is all, if your Honor please.

Mr. Farley: Do you want to hear me on the objection?

The Master: Yes.

Mr. Farley: That is all I have of the witness.

Mr. Spohn: That is all for the witness.

The Master: Is this exhibit being introduced not only to show the operations, but also as evidence of the time it took?

Mr. Farley: Yes, your Honor, introduced as evidence of the time the operation took, as a record made by this particular witness who was familiar with the facts at the time the facts occurred, made in his own handwriting, and also as secondary evidence, and we will produce the witnesses later to explain the practice of the Ford Company with respect to the destruction of these time studies, and we will show the original time study from which the man made this particular copy is no longer in existence and not available. It is not secondary evidence. The witness testified he positively made it from a time study that was in existence at that time. I think under all the facts it is clearly admissible.

Mr. Spohn: If your Honor please, may I defer my argument on that until we hear the witnesses?

The Master: I think for some purposes, without having the other witness' testimony, that this document will be admissible.

The witness has testified that he is thoroughly familiar with the operation, and that this record is an accurate record of the operations at the time.

I think on his testimony alone, without the other testimony, **(319)** it would be admissible for that purpose, but when it comes to the actual times that are set forth there, this witness has never clocked or timed the various operations, and for that purpose it is only secondary evidence.

On that question I think I will have to withhold my ruling until you show the primary evidence is not available.

I think you can go ahead and question the rest of the witnesses, however, just as though it were admitted into evidence, and I will withhold a ruling until such time as the further proof is submitted.

Mr. Farley: That is all, Mr. Libby.

Mr. Spohn: With respect to your ruling I want to point this out.

One of the basic reasons of the objection to the exhibit, even for the limited purpose for which your Honor received it, was it has no definitely fixed time.

In other words, the witness' testimony was he copied it from a time record. He doesn't know when that time study was made. So far as this record shows, that time study may have been made in 1918.

Mr. Farley: I don't think it makes any difference when it was made. It is a record of the operation of those shapers.

The Master: It was a time study which was in use in the department some time in 1923 or 1924. I think that the witness' recollection is sufficiently good on that point to assume that that is the truth, that he did copy it, the time study, during one of those years.

The original time study may have been made in 1918, and (320) under his testimony possibly not revised since then, but if it was not revised, it would appear from the system employed that it was not revised because there was no radical change necessitating a revision.

I am inclined to think that your objection as made has something to do with the weight to be attached to the evidence, but I think the document is admissible, and I will admit it, except for the purpose of or except as evidence of the actual time of the various operations. I don't think it is yet admissible for that purpose.

Mr. Farley: All right. Now I will have Mr. Shawkey resume the stand.

Morris E. Shawkey was thereupon recalled as a witness on behalf of the Defendant, and having been previously duly sworn, testified as follows:

Direct Examination by Mr. Farley (Continued).

Q. Mr. Shawkey, when you were asked to retire from the stand I think we were discussing this Libby notebook and what you did with the notebook after you got it from Mr. Libby. Will you resume from that point? I think it is all right, unless you want the reporter to read back to you what you were saying. A. No, I recall I was saying I had taken the book with me to Mr. Klopsic and let him look over it, and we thought it would be a good idea to immediately have photostats made of it.

Q. What else was done with it? Were there any other copies made in addition to the photostats, if you know? **(321)** A. Not that I know of. Yes, Mr. Klopsic copies off—he had the typist type an operation sheet or time study form from this book.

Q. And then did Mr. Klopsic turn over to you the book and operation sheet which he had typed? A. Yes, he did.

Q. I show you an exhibit which is marked for identification Exhibit M here, and ask you whether or not that is the sheet that Mr. Klopsic turned over to you? A. That appears to be the same, yes.

Q. After you received that sheet, Exhibit M, did you check it with the note book and the times given at any time? A. I was looking at this. I don't believe I got the wording of the question.

Q. I say, after you received the sheet Exhibit M, did you check that sheet then with the information as contained in the Libby notebook? A. Yes. We run over the figures to see that they corresponded.

Q. You made a check with Mr. Klopsic on that? A. Yes.

* * * * *

(322) Q. Did you make any searches through the files of the superintendent's office, or any other place, particularly for time studies and operation sheets? A. Yes, I did.

Q. And did you locate any other ones? A. I located a time study sheet in the superintendent's office.

Q. Are you familiar with the practice of the company concerning operation sheets in the work that you were doing in the cam shaft department? Was it any part of your duties to refer to time study operation sheets? A. Yes, quite often, to make me familiar with the times of the various operations, and the way—I am at a loss to express myself,—the following of operations, if I make myself clear, how they were arranged, one operation after the other.

Q. That is, as I understand your testimony, you men in a position of foremen, more or less in authority there, regularly use the time studies as a part of your regular duties in order to be thoroughly familiar with the sequence of operations? A. Yes.

Q. And also the time which is supposed to be consumed in the various operations? A. Yes.

(323) Q. I show you an exhibit marked Exhibit N, and ask you if you can state what that is? You were speaking about the fact that you found an operation sheet. Is that the operation sheet you procured? A. That seems to be the operation sheet that I found in Mr. Smith's office.

Q. And who is Mr. Smith, please? A. The building superintendent.

Q. Of what building? A. The motor building.

Q. And is that the building in which the Department 410 camshaft department is located? A. It is.

Q. And from whom did you procure that particular sheet? A. I went through the file myself. I don't know if all the papers were in there, and I found this sheet among those papers. There were several sheets that had reference to various things in the camshaft department that were in a file 410, and this was among the papers.

Q. Let me ask you, Mr. Shawkey, was there in the superintendent's office a regular file of operation sheets or time study operation sheets, a current file for the work then in process or then being used? A. I couldn't say to that, because I asked the superintendent's clerk if he had in his files any old files for past periods, and I don't know. I didn't go through all his drawers. He pulled this one out with a lot of other old information there.

(324) Q. Miscellaneous papers? A. Miscellaneous papers, and this was found among those.

The Master: Did you yourself go through all those miscellaneous papers?

A. Yes.

Q. And that was the only operation sheet you could find in those miscellaneous papers? A. Yes.

Mr. Farley: I offer this in evidence as Exhibit N as a paper found by this witness in the regular files or records of the Ford Motor Company and produced by him from those records.

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(The hearing was resumed pursuant to recess.)

(Parties present the same as before.)

(335) The Master: You finished your direct examination?

Mr. Farley: Yes. I would like to offer in evidence this Exhibit M, which is the re-typing of the material on the Libby notebook, which was done for convenience in attaching it to our statement of account, and about which the witness just testified.

Mr. Spohn: If your Honor please, in respect to the offer, if it is to be received at all, I move that the date of April, 1924, be stricken from the offer on both sheets. The testimony is clear as to the day of its date, so far as the recollection of the witness is concerned.

The Master: I think from the testimony it is not known whether it was in April, 1924. You might change this to 1923 or 1924.

Mr. Spohn: If that is done then I ask the month of April be stricken off.

Mr. Farley: No objection so far as I am concerned.

The Master: It doesn't indicate on its face—yes, it does, too—it indicates that it is a copy of the Libby notebook. I will just cross out 1924. Have you compared it with the original exhibit?

Mr. Spohn: May I have a minute to do that, your Honor? **(336)** If your Honor please, I don't see on the bottom of the exhibit—Mr. Farley, am I wrong in this?

Mr. Farley: No, there are some additional things.

Mr. Spohn: Weights, and so forth.

Mr. Farley: That have been put in here that I will examine Mr. Klopsic about.

Mr. Spohn: If we may stipulate that the weights appearing, rough weight 5.865 pounds, finish weight 3.2050 pounds, and the next words, "forging steel," are not in the original Exhibit L and subject to further proof by counsel, then I won't have to move to strike it out.

Mr. Farley: So far as I am concerned this may be stricken, because I don't think it has any relevancy.

Mr. Spohn: Then I move it be stricken.

Mr. Farley: To any of the proceedings here. I think it will save time, if instead of examining the witness on it.

Mr. Spohn: As I understood the tendered offer of Exhibit L was admitted not as evidence of a minute consumption as set forth therein, am I right on that?

The Master: That is correct. Exhibit M will be admitted as simply a copy of Exhibit L and admitted subject to the same limitations.

Mr. Spohn: And received for the same purpose as Exhibit L was?

The Master: That is right.

Mr. Spohn: I want to offer the same objection to the reception of Exhibit M as Exhibit L.

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(337) Mike Klopsic was thereupon called as a witness on behalf of the Defendant, and having been first duly sworn, testified as follows:

Direct Examination by Mr. Farley.

Q. State your name, please. A. Mike Klopsic, K-l-o-p-s-i-c.

Q. And where do you live, Mr. Klopsic? A. 1450 West Grixdale Avenue, Detroit.

Q. You are employed by the Ford Motor Company, Mr. Klopsic? A. Yes, sir.

Q. And what are the nature of your duties at the Ford Motor Company? A. Foreman of the time study department.

Q. How long have you had that particular position? A. Somewheres since 1928. I will not be able to recall the month. Anyway, it was at the beginning of Model A. That will give you the date. I don't recall just when.

Q. Model A was shown to the general public, the first showing of Model A was December, 1927? A. It was at the beginning of 1928. It was in the month of March. I am not going to say which year it was.

Q. If it was the beginning of Model A that would make it 1928. How long have you been employed by the Ford Company, Mr. Klopsic? **(338)** A. Since November 11, 1913.

Q. Now, how many men do you have working under you at the present time, Mr. Klopsic? A. You mean only at the Rouge plant?

Q. Well, generally. It doesn't make much difference. I thought I would let you give in general the extent of your employment. A. Somewhere around 90.

Q. Of that number, how many are at the Rouge plant? A. At the Rouge plant there are 25 or 24.

Q. As a part of your duties do you supervise time studies, not only at the Rouge plant, but all the various branch plants of the Ford Motor Company? A. Yes, sir; both in this country and in Europe.

Q. Now, will you explain to his Honor the general system used in your department and at the Ford Motor Company in the making of time studies? A. We use the decimal timer, double action.

The purpose that we use only this watch is because it has two large hands. When we start an operation and it continues, if for any reason there is avoidable delay, we press on this and we stop one hand. Then we count, take into consideration only between this hand and this hand, which gives us the amount of lost motion.

Q. Then when the lost motion ceases, you press the other button? A. Release it again when the lost motion is started, then we release it. One gets accustomed to it.

Q. Now, when a time study is made by your department, Mr. Klopsic, do you time—state just how you make that sort of a time study. Let us assume, we will say for the purpose here we **(339)** are concerned only with the cam

shafts, manufacture of cam shafts. Are you familiar with the cam shaft department? A. I am in a general way. I don't myself at the present time make time studies but I check them to see that they are fairly balancing with the actual time paid by the company.

Q. I think for the purpose of making your test perhaps more readily understandable, I will show you an exhibit which is marked Exhibit 7, and attached to Defendant's first statement of account which has been introduced in evidence as Exhibit A, or marked Exhibit A, and I will ask you just what this Exhibit 7, which is entitled "Operation Sheet" is, by name cam shaft symbol A-6250. It has at the bottom of the sheet, "Revised 7-1-31 by M. K." Who is M. K.? A. That is me.

Q. Now, did you make that particular time study to which your initials are attached, or was that made by somebody under your supervision? A. By one of the men working under me and on his original would be found his initials, if that could be procurable.

Q. Now, will you explain in general about that type of time study and just how they are made? A. This time study, or any time study under my supervision must be studied.

We have a ruling that it must be studied a sufficient length of time, the sequence of the complete operation, until the observer will find delays, if any, and so record them with the foreman.

That varies. Shall we say an operation that will require **(340)** 2/10 of a minute, it would be studied generally at least 10 minutes.

Under no consideration a time study man is to put down the figures with less than 20 minutes study, when operations are requiring say four or more minutes, because we believe it is not possible for the eye to find lost motion, and the accuracy would be more questionable on the end of the month when the total hours charged to that part number and the total time study, then the study would be then out of balance, if we did not time study long enough.

Q. When you make those time studies are they all made with a stop-watch? A. Yes, sir.

Q. Now, as I understand your testimony, your instructions are that the man must time the operation over a sufficient number of pieces so that he gets a fair record by

use of the time study and the use of the stop-watch? A. Yes.

Q. Now, with respect to that particular time study which you have before you, I call your attention to operation 14 made on July 1, 1931, and can you state whether or not you know what machine or what operation that is, and what machine that operation was performed on? A. No, I can not state on what machine that was performed on, due to the fact that I myself did not make the time study.

Q. Is that, however, a record from your department and a record made under your supervision? A. Yes, sir.

The Master: What is the purpose for which you make these **(341)** time studies?

A. There are two purposes. For cost accounting and for elimination of lost motion.

The Master: If one of your men is making a time study and he discovers for a particular operation there is considerable unnecessary delay, so that we will say the operation should be capable of being performed in half a minute, when actually it is being performed in one minute on the average, which of the two times would be set down on the time study as being the time for the operation?

A. Always the one, the reliable one which is at that time performed, and not the future one, what it should be. When it is necessary to make a new time study, which in the case your Honor specifies we would make a new time study after the operation has been corrected.

Q. When you make a time study, Mr. Klopsic, or referring to this particular one Exhibit 7, and I call your attention to the column under the heading "Minutes," just what does the minutes necessary for this operation 14, .7143, what does that indicate, machine time or man time? A. Combined time, handling and machine time.

Q. But the record .7143 is the record of the man, the entire time on the man to produce one piece, is that correct? A. That is correct.

Q. Now, do you know what the purpose of making those time operation sheets is for? For what purpose are they made? A. They are used in the accounting department for cost purposes and on a yearly inventory, for the inventory in process, pricing.

(342) Q. Are they also used in any way by the foremen of the various departments? A. They are.

Q. For what purpose, if you know? A. I do.

Q. Thank you. A. For the purpose of keeping within the cost specified in the time study. Each foreman will first see the time study before he will O.K. it as all right, or it will not come to my desk.

Q. Now, as the time given, and we will restrict the answer to this particular operation 14, .7143, does that represent actual time as shown by your stop-watch, or is there any allowance computed in that particular? A. There is always an allowance added. That is according to the fatigue of a human body.

For example, a man working on cylinder blocks, if he were to lift cylinder blocks all day, he can not perform, he would get tired, and an allowance must be made.

An allowance must also be made for personal duties, and it must also be made—allowing the distance from his place of work to that of lavatories and so forth. That allowance must be made. It varies.

In some departments where the work is lighter, we will probably allow 14¼ per cent, that is, to the entire figure arrived at by the observer, and not only on the machine time and man time, but combined time.

Q. What is your usual, more or less standard allowance? A. Well, I believe that we would come nearer 20 per cent on an **(343)** average, than we would to any other figure.

Q. And in making this allowance is there any consideration given by your department to such things as the necessity for changing tools in machines, and machine trouble, and that sort of thing? A. Yes, sir.

Q. And in connection with an operation which involves the use of a machine, and not merely a purely manual operation where no machine is involved, what is your ordinary allowance there? Would it be the 14 per cent or the 20 per cent? A. Where no machine is used?

Q. Where a machine is used as distinguished from one where it is a purely manual operation. A. It would be 20 per cent.

Q. Then can you state whether or not an allowance of 20 per cent is included in this figure of .7143 on the opera-

tion sheet Exhibit 7 for the A-6250 shaft? A. Yes, I believe it was.

The Master: Do you know whether it was 20 per cent or 15 or 25, or do you simply mean there was an allowance made?

A. There was an allowance made, whether 20 per cent or 25 per cent, I have no means now of checking back, but that it was not less than 14¼ per cent, I am sure.

Q. Do you know what particular individual in your department made the time study from which this sheet was made? Does this initial G. Z. throw any light on that, or is that the name of the typist?

The Master: Can you tell generally whether that would **(344)** be the name of the man who made the time study, or the typist?

A. Generally it is the man, but I could not say G. Z. is. I am afraid that is the typist's initial, because I am not familiar with the name, of ever having had any time study man with the last letter "Z."

Q. In 1931, were you making time studies yourself, in July of 1931? A. I made some time studies.

Q. Would the fact that your initials M. K. appear on there, would that indicate you yourself might have made that one, or did make that one? What is your practice in that respect? Do you put on the time study the initial of the man who made the time study, or are all time studies that are made in your department,—do they contain your initial? A. They all contain my initial, but also the initial of the man that made the time study.

Just when that was started, these sheets do not provide that space, but now we have the same form number that does provide space for the initials of the observer.

I might have myself made that time study. I might have made it myself.

The Master: Where did you get this 14¼ per cent figure from? You are getting down to fine points of accuracy when you split percentages.

A. 14¼ per cent. In other words, of 480 minutes is about ⅛, allowing for personal duties, just about ⅛, I believe, 14¼ per cent of 480 minutes. That is 68.4 minutes.

The Master: I was just interested in knowing how you **(345)** arrived at the figure 14¼ per cent as being the minimum allowance for non-productive time.

A. That is not accurate at all. The working man's cycle will go somewhat like this:

First hour, second hour, third hour, fourth hour, fifth hour, and so on, will rise from the morning work, continue on quite an even scale until about the sixth hour, seventh hour. Whether he wants to or not, a working man has a very hard time to produce as much as he did at the fifth hour.

In the third, fourth, fifth, sixth hour he will produce, if conditions permit, more than he will in the first or last hour.

That is generally applied, I believe, by all time study departments.

Q. And do you find that to be true as a result of your own observations? A. Yes, sir.

Q. How long have you been doing this time study work, Mr. Klopsic? A. Since 1928, about 10½ years.

Q. Now, when the time study, such as this Exhibit 7, is produced, it is submitted to you, you say, or rather, it is submitted to the foreman before you get it. What, if anything, do you do towards checking the correctness of that time study before letting it become official? Let me ask you this first: I assume that before these time studies are put into practice there that they must be approved by you, is that correct? A. By me or my assistant. I have an assistant.

Q. And who is that assistant? A. His name is Frank Dorsey.

(346) Q. Now, what, if anything, do you do towards checking the correctness of that time study before you permit it to issue from your department? A. If it is away from actual conditions it does show, when variation appears greater than warranted, but the reason of time study, perhaps the reason the time study was made first, was because operations changed, either the sequence of operation or some improvement has been made, and if the variation of time varies too much to be safe, we re-check it.

We send a man back to check it again to be sure that we will be within balancing time of the time department, which is under another departmental head.

Q. Now, when you say because of a change of an operation or because of an improvement, just what do you mean by improvement there? Do you mean improvement in the product, some change in the construction of principle, or do you mean improvement in the machines or methods, or do you mean both? A. I mean both; that if an operation is combined with another, or eliminated, although the design may remain the same, the cost is affected which demands that I make a new time study.

Q. From time to time changes are made in the various parts by the engineering department, and the engineering department informations issue? A. Yes.

Q. To make some change in the construction of a part, and even if it were only as to one portion of the part, that is one thing that would necessitate a new time study? A. I receive from Mr. Sheldrick every engineering change issued **(347)** by the Ford Motor Company. A copy is forwarded to me in order that I maintain a schedule of what to do.

Q. In order that his Honor may understand that system I hope I may do a little leading to shorten the thing up. At the Ford Motor Company they have an engineering design or department which devotes its entire time to changes in the construction of the car; that is Mr. Sheldrick's department, is that right? A. Right.

Q. And whenever a change is made in any part of the construction that is when an engineering information is issued that one is being made? A. Yes.

Q. And you say you get a copy of every one of these engineering informations? A. Yes, sir.

Q. And it is your duty to inspect those, and if you find any change has been made in any of the parts of the car, then it is your duty to send a time study man to check that operation, that is correct? A. It is my duty to give each time study man—they are assigned to certain buildings, and I give those parts that are manufactured in that building, I give these engineering informations to the time study man. It would not be sometimes quite possible for me to read them all.

Q. Then what does that man do after he gets the engineering information from you? A. He first checks whether it is a material change, like forging **(348)** or casting, whether it is to be purchased on the outside or to be manu-

factured. At times changes occur that we buy parts on the outside, and we make parts sometimes at the factory.

Then he would change, if an operation change is needed, and he will go to the department manufacturing that part and make a new time study.

Q. And check with the foreman of the department? A. Yes, sir.

Q. Very well. Now, supposing you get new machinery into one of the departments to perform an operation that was formerly performed by another machine, how is that sort of thing brought to your attention? A. On machinery purchased by Mr. Kellogg's department, when an installation order is issued, I receive a copy of that order.

Q. And after you receive a copy of an order showing the installation of a new machine, what is then done? A. Immediately the machine is installed. If it is a new machine, that it will change the times, we will make a new time study, but if it will not change the actual time required to perform the operation, then we may not change it.

Q. In other words, if a new machine is purchased and is of a different type from the machines that had heretofore been used in the department, you would make a time study? A. Yes, sir.

Q. But if a machine coming in, a new machine coming in, was of the same type as already had been in use in the department, you might not make a time study of that one? **(349)** A. I might not make a time study if the machine is simply added because of larger production may be required.

Q. Now, after these time studies are prepared and checked and approved by you and you are satisfied that they are accurate, what then is done with them? A. One copy goes to the accounting department, one copy goes to the foreman, general foreman in the department, and then they are all for foreign branches. They are mailed, such as Walkerville, Degenham and Germany and France, wherever they manufacture.

Q. Degenham is the English plant of the Ford Company? A. Yes, sir.

Q. When you prepare a new time study what happens to the former time studies that you have prepared, or let us say between the period when you started in the department until quite recently what was the practice? A. Until quite recently the old sheet was always destroyed

when a revised sheet was issued, because of the tremendous filing space, and it was not deemed necessary, I presume, by the executive department, of which I would have no knowledge.

The Master: In connection with the answer to the previous question, did I understand where you make a time study you retain the original or copy in your own department, as well as sending them on to these other departments that you mentioned?

A. Yes, one copy, the original, is kept.

Q. And when you issue a new time study and send it to the foreman of the department and to the accounting department, is it the duty of your men to collect the old one and see that it is **(350)** destroyed? A. No, it is not.

Q. Whose duty is it, if anyone's, to destroy those old ones? A. The timekeeper of the department should, according to instructions, when he receives a new operation sheet, should pull out the old one and destroy it and insert in the same place the new one.

Q. Do you know the reason for that practice, in so far as the time study man of the department is concerned, of destroying the old one? A. No, I do not.

The Master: With respect to the copies that are sent to the accounting department, do you know whether those are destroyed, and if so, under what circumstances?

A. Until very recently they were destroyed after either obsoletion of a model or discontinuance, or when a new operation sheet was issued the old one was destroyed.

The Master: That was true of the accounting department as well as the copies sent to the foremen of the various departments?

A. Yes.

The Master: Whose duty was it in the accounting department to see that the former sheet was destroyed?

A. The cost clerks figuring those parts when receiving a new operation sheet they each had there on file, and we will say when they get one they simply pull the old one out and insert the new one.

The Master: Are there instructions on the sheets themselves **(351)** to that effect?

A. No, that was all done by, shall we say verbal request, or understanding? I don't know. I always understood it. Before I was a time study man I worked in the cost department myself figuring costs in money and I remember that that is what they did.

Q. That was the instruction you had when you were in the cost department, to destroy the old sheets as soon as you got the new ones? A. Yes, sir.

Q. Now, in so far as your own department is concerned, what orders have you there in that department in so far as destruction of the old sheets were concerned, when the new sheet was gotten out, or what was the practice there when the sheet was made? A. The practice was the same until recently, when we were instructed to file the old sheets. Until then we always destroyed obsolete operation sheets.

The Master: When you say recently, what date are you referring to?

A. I would say it is maybe a couple months ago.

Mr. Farley: I might say, if the Court please, there that in view of the experience I had in this case discovering records that orders were issued that there be a complete file kept in the future of all operation sheets prepared at the Ford Motor Company.

Q. (By Mr. Farley): Now, Mr. Klopsic, I would like you to first look at this Exhibit L, the notebook which has been introduced here, and ask you to examine it and state whether you have ever seen **(352)** that before? A. Yes, I have.

Q. Well, will you please state the circumstances under which you saw that notebook? A. Mr. Shawkey brought this to my desk. I will not say what date it was, but for the purpose of convenience I had an operation sheet copied off of this, just as it was written, using the same figures as they appear in this book, and that is all I did with the book.

Q. I show you the 2 sheets that were marked Exhibit M, and ask you if you know what that is, and if so, to state?

A. That is the sheet that I requested to be prepared. I felt that it was going to be for convenience. That was all.

Q. Prepared from what? A. From this book.

Q. And the data appearing on the operation sheet Exhibit M, is that precisely the same as contained in the notebook? A. Precisely the same. That was the sheet.

Mr. Farley: I think that this already has been offered.

The Master: Yes.

Mr. Farley: And it is received subject to the objection made against the notebook.

Mr. Spohn: I suppose it doesn't make any difference, but there is a total on this page that was not on the other, and without taking the time to add it up, I don't suppose the total is material.

Mr. Farley: No, I don't think so.

Mr. Spohn: I suggest the total be stricken. Otherwise we **(353)** have got to add it up and see if it is right.

The Master: Let us strike the total.

Mr. Spohn: It is not material, anyway.

Mr. Farley: That is quite right.

The Master: After these time studies are made, is there any attempt on the part of your department or any other department to check the production to see that it corresponds with the production which should be obtained according to the time studies, if you know?

A. Yes. Form 2002-B, I believe it is, on top of that form is inserted the latest time study, the best month, and naturally the actual minute cost of that time. Mr. Woehrle had the form like that here.

Q. Here is Form 2002-B, Exhibit H. That is the form you are referring to? A. Yes. You see they insert that time study. In here are inserted the shift hours. This would be shift No. 1, which would be from probably 11 o'clock at night to 7 in the morning. That would be from 7 to the afternoon shift, and that would be from afternoon to 11.

Then these hours are totaled and production inserted.

The minute cost is figured daily on the form. If it varies to a great extent, what he has here, it is immedi-

ately called to our attention. Of course, that will not give operation cost.

The Master: To make the record clear, you mean if there is a material variance from the time in the time study then it is called to your attention?

A. Yes.

(354) Q. (By Mr. Farley): If there is a material variance which persists between the total times as given by your time studies, what then happens? Do you re-check the job or does it run on without any further check? A. What happens to all of us who work at the Ford Motor Company in the time study department, we will know quite well when it does happen.

Q. Then what do you do, Mr. Klopsic, when that does happen? That might be called the first reaction, and after that first reaction, Mr. Klopsic, what then happens? Do you put your men back on checking? A. Either that observer will go to the job immediately, which most of the time is not rapid enough, and I have to go and do the work myself.

The Master: Are your time studies expected to give an accurate representation of the amount of time to do the job whether you are having low production or high production? Is there any effect of production on the accuracy of the time studies, as representing the actual production?

A. We make great attempts to be as near up to date as humanly possible, and we strive to always issue new sheets for parts that require lower production, which has a bearing on cost.

Shall we put it this way, your Honor: When a model changes and the obsolete model production is lowered, we must issue new sheets, new time sheets, because of the lowered production.

The Master: Even though the operations themselves are exactly the same?

A. Yes.

(355) The Master: Is there any general correlation between low production and the amount of time it takes to do the job? That is, can you state when the

production is low the time for the operations rise, or is less than when the production is heavy?

A. Only in handling, your Honor. The variation is only in handling, delivering to machine, because the flow is not constant like in full production.

The variable will be in handling the stock.

Machine time will not change materially, unless an operator, for example, will run three machines during high production, and two or one and part time one. That will have a bearing then on what he can produce.

Q. When you say two or one or part one, you mean on low production? A. On low production.

Q. Yes. Now, do you know, Mr. Klopsic, did the Ford Company have a time study department at the Highland Park plant? A. Yes, there were two men working, Mr. Bennett and Mr. Marentette.

Q. At the Highland Park plant? A. At the Highland Park plant.

Q. Since you took charge of the time study department in 1928 where has most of your work, in so far as the Ford Motor Company here in Dearborn or in River Rouge, or wherever you want to call it, has most of your work been in what we call the Rouge plant or Highland Park plant? A. Most of my work in time study has been in the Rouge plant.

Q. Before you started your time study department in the early part **(356)** of 1928, do you know whether or not there was any time study department at the Rouge plant? A. There was not.

The Master: Do you have a separate department called the time department?

A. The time department is a separate department, yes, sir.

The Master: What is the function of that department, just to keep a record of actual time spent by the workman?

A. The foreman in charge of that department is the boss of all time clerks, keeping the Form 2002-B, extending the clock cards, balancing the time from daily foremen's time reports.

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(373) The Master: What kind of checks have you made on the accuracy of your time studies, generally? Have you ever, for example, had two or three different men make time studies of the same series of operations unknown to each other and to check up their results?

A. Well, that is done only periodically. You change men around. That is done periodically, say every three months. A man that now works in one building in approximately three months will be assigned to another building, and the other man from the other building will come to his building.

The Master: When they are shifted around the man who is shifted doesn't immediately make new time studies of all the operations in the departments that he is now assigned to, does he? He simply waits until some occasion arises for a new time study to be made, the same as the old man did?

A. Oh, yes.

The Master: Have you ever made any experiments to see how closely two different men in your department would come in their time studies on the same series of operations, at the same general time?

A. It is not deemed necessary, because we use Form 2002-B to state and show the facts, how much, how many hours or minutes Ford Motor Company has paid in wages to workers to produce that, and if our time study is out of balance on that, as stated before, I would very quickly be informed that something is wrong.

(374) The Master: When one of your men is making a time study, might not the man observed speed up during the particular period in which the time study is being made, and consequently go through a series of operations in much less time than he ordinarily would?

A. We time study in the plant approximately six hours a day.

The department starts at 8 o'clock, while production starts much earlier than that, and the time study men come into the office to make their computations of the last

hour or hour and a half, so that the most time for observation is generally between 8:30 to 3 or 3:30, which is, we believe, the best time to study under most productive and efficient hours.

Mr. Farley: You haven't really answered his Honor's question. What he was asking was, don't you find that when one of the operatives on the machine sees one of your time study men holding a stop watch on him, doesn't he slow up so that he won't get too much time, so that he won't have to work too hard?

The Master: Or speed up.

Mr. Farley: How do you prevent that from happening?

A. Pardon me. I did not understand the question. That we are not, because we are not paying piece work and the men do not fear the time study men like they do where a piece rate is paid, and to my knowledge no complaints have been registered that I know of that any operation has been excessively sped up.

Mr. Farley: Or slowed down?

A. Or slowed down.

Mr. Farley: Suppose you had any reason to expect that the (375) operator was trying to, let us say, put one over on the time study man, would you let it go at that, or do you go back and check, or how do you handle that situation. Surely that must have arisen.

Mr. Spohn: I understand the witness has said there has been no complaints of any operation sped up or slowed down.

Mr. Farley: It seems incredible to me.

Mr. Spohn: I admit it, but if that is the witness' understanding of the situation, all right.

A. Now, no complaints that I know of, if you mean to my department by men, because we don't time study one man if there should be, say, 15 men performing the same operation. In our time study it must be included; all 15 men must be checked.

The Master: You don't pick out one operator and base a time study on that?

A. We do not carry around at the Ford Company so-called speed experts or professional operators for time

study purposes. The man that performs the operation is the man to be time studied, and not unbeknown to him.

The Master: Here with this particular study you have just a single man performing the operation. At the time this department was on Model A cams or Model A cams were being produced in the department, there were quite a number of machines and a number of men running them, under ordinary conditions of production?

A. Yes, sir.

The Master: In view of that fact would you consider that this time study made of the operations of one man is reliable?

(376) A. The man who operated that machine, I would say is reliable, because he operated machines, so I was told, but he operated the machine quite efficiently.

The Master: When you take a time study, I presume you have done it yourself, you have taken time studies where you have had as many as, say, 10 or 15 men operating the same machine during the day, and clocked the different men. What do you ordinarily find with respect to variations in the time of operations of the time taken by the various men to perform the operations?

A. Oh, that is sometimes quite a variation.

The Master: What do you do in a case like that when you find variations? Do you take the average?

A. Average of all men.

The Master: Now, if you averaged 15 men, then, for example, in the camshaft department during the period when the Model A camshaft was being produced, in operating the Melling cam lathes, and if Pillinger was one of the men operating at the time, a time study of his operations might have shown considerably different results from a time study of anyone of the other 15 men?

A. Yes.

The Master: How much difference? Would you say as to what the maximum variation would likely be? Would it be 20 percent, 50 percent?

A. No, it could not be more than 10 percent variation, I don't believe, in men. It could be, but it generally isn't.

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(431) RALPH T. MYERS, a witness called on behalf of the Defendant, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. What is your name, sir? A. Ralph T. Myers.

Q. And where do you live, Mr. Myers? A. I am living at 10 Roosevelt Boulevard, Cohoes, New York. I just moved down there.

Q. You are employed by the Ford Motor Company, Mr. Myers? A. Yes, sir.

Q. In what capacity? A. I am foreman of the Green Island plant.

Q. The Green Island plant is where? A. Green Island, New York.

Q. That is near Albany? A. Seven miles from Albany.

Q. Is that an assembly plant of the Ford Motor Company? A. No, it is manufacturing.

Q. Manufacturing what? A. Manufacturing radiators, roller bearings and car springs.

Q. Now, before you were assigned to the Green Island plant of the defendant, the Ford Company, where were you? A. Why, I worked out of the superintendent's office in the motor building the last year.

Q. And before that? **(432)** A. Department 410, the camshaft department.

Q. You were general foreman of that department? A. Yes, sir.

Q. How long have you been employed by the Ford Company? A. I went there in 1913.

Q. Now, as general foreman of Department 410 you were familiar with the various operations performed in that department on the camshafts? A. Yes.

Q. And with the machining of the cams of the camshafts? A. Yes, at that time, after I went in there.

Q. What time did you go into that department as foreman? A. I think I went in there in June, 1929. It might have been 1928, but I know the month was June.

Q. At that time what type of shafts were they making in the department? A. Model A.

Q. You went there shortly after Model A production started? A. I believe they were making about 3,000 a day.

Q. When you first went in the department? A. When I went in the department.

Q. You remained as foreman of the department until 1936 or thereabouts? A. 1937, I think about October. I went out of there in 1937.

Q. Now, when you first went into the department what type of machines did you use in the department for the machining of the cams of the camshafts? A. Well, we had what they call the Melling lathes, or Walcott lathes.

(433) Q. Do you have a present recollection of the average production of those lathes in machining the Model A shafts? A. Well, approximately. I couldn't say right to the shaft.

Q. What did you count on getting? Was it part of your duties as foreman to know what you could expect per man in a general way per day? A. Yes, sir.

Q. On the various operations? A. Yes, sir.

Q. What did you count on getting per man in the operation of the Walcott lathe? A. Well, if I remember properly, I think a man run 2 lathes, and we used to figure,—we used to work for 500 in 8 hours.

The Master: Was that the top amount you were working for, or is that what you expected to get?

A. The job was good for that if you didn't have any tool trouble and that man worked eight hours. If you had tool trouble you would not get that many. We figured 50 an hour average working 8 hours in and out. We used to work 3 shifts. If you had a good shift, why, you got 30 or 35 an hour on that kind of machine. The time study would show somewhere near what we got. I am recalling the best I can.

Q. You spoke of the fact that machine trouble possibly might cut down production. Did you have any particular

amount of machine trouble with the Walcott lathe? A. Yes, we did. They caused a lot of trouble.

Q. And do you remember how many maintenance men you had to have in the department to keep those lathes up, or did they come **(434)** under your immediate supervision? A. That come under a different foreman. He handled the toolmakers of the building, but if I didn't get enough production it was up to me to holler for more men, and I know we had on the average of 4 or 5 mechanics on that one particular thing. Occasionally they would be put on a spare job here and there, but it kept them pretty busy on the cam lathes.

Q. Who was the foreman of the toolmakers? A. A man by the name of Pillinger. You mean the cam lathes or toolmakers?

Q. I was inquiring of the general foreman of the toolmakers. A. John Schmid. Pillinger was the man under him in that division.

Q. Who was in charge of repairs on the Walcott lathes? A. Yes.

The Master: What were the difficulties you were encountering on the Walcott lathes?

A. They had these overhead slides and the slides used to stick. That was one of the main troubles and it was a bad job on tools too, of course.

Q. You mean by that tools had to be replaced frequently? A. Yes.

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(479) Q. Very well. Will you just go through the series of steps up to the machining of the cam? A. This is the rough forging, the way I receive it from the **(480)** forge shop.

Q. That is Exhibit 28, that is the way the cams came to you? A. Yes.

Q. What is the first operation done in your department? A. The first operation, I machine these ends to length.

Q. That smooths up the two ends? A. That is right. In a Davis-Thompson machine we milled them.

Q. Then what came next? A. We centered them.

Q. By centering you mean you put this little hole on? A. 60 degree included angle for centers of your lathe.

Q. And that centering is done in a centering machine, holes are drilled in there? A. Yes.

Q. What comes after the centering? A. Then we had a straightening job on the center bearing. After we centered that we located from the rough bearing itself and we centered that, and then from the center itself, this here naturally will run out, and we straighten that job down and naturally it pulls in the center line.

Q. That is to prepare the shaft for the next operation? A. Yes.

Q. Which is what? A. Rough turn the center bearing. At this point we can put no steady rest on that shaft yet. What we have between centers there, we use an air chuck on this.

Mr. Farley: I might state I am doing this so that it will help you to understand these operations, and I hope you will feel perfectly free to interrupt at any point if you have a **(481)** question yourself.

The Master: I didn't get this straightening operation straight.

A. Mill to length, the first operation we do, then we center both ends at once. That is the second operation. The third operation, the shaft is the same as this rough forging, only it is milled off and centered. Then we straighten between centers on a chuck press, and sometimes that is run out ⅛ of an inch, and pull that shaft down. We use a gauge, or a good man can use his eye.

Mr. Farley: The centers are put in for the purpose of mounting this in the lathe.

The Master: I understand.

Q. And it is rotated on the centers, and if after those centers are put in, have been located by these two ends, this part should be out of round or eccentric, then they put it in the press and straighten it? A. We center on these two bearings and pull these two bearings with this bearing, what we would clean up.

Q. Now you have got your rough turn center bearings. That is the operation you describe? A. Yes. Then the next operation, we turn between cams.

Q. Let us see if we can give those numbers as we go along. No. 1 was mill ends. 2 was center? A. Right.

Q. 3 was straighten? A. Right.

Q. 4, turn center bearing? **(482)** A. Yes.

Q. Now you are to 5. A. I am going to change that operation now. I am going to recess this shaft. We are going to recess this. That is where we have got the length of this bearing from our center out here and also the side of that cam. This happens to be a V-8 shaft. We won't take that into consideration. Now, let's see, we turn between cams before the recess, the recess before the cam. Either one way or the other.

Q. I don't think it makes any particular difference so far as the issues here are concerned. A. I am almost sure we recessed it first, but I might be wrong on that. We had a tool here and if that cam was out of location we got the side of that cam as well. With these ends tools you get your bearings to length.

Q. Then the recess would be 6? A. Either one or the other.

Q. The turns between cams would be 7, shall we say? A. That is right.

Q. Then what after that? A. Then we come down here and we turned, I think we turned the gear post.

Q. That would be 8? A. Maybe we come back and turned these two bearings off the center bearing. Now, whether we did that before the post end, that is not just clear to me. This is one operation, rough-turning this post and facing here and turn that O. D. there. We can turn that O. D. when we turned this flange. That takes the steady rest.

(483) Q. You are referring then to Exhibit 29. Now, what after what you just described? A. We have to get down further. Well, that is all right.

Q. What would be the next operation? A. Taking for granted that these are turned now. We had a short hole here. We call it a construction hole. The hole didn't mean anything to the job. We put that hole in there, locating from a certain cam. That gave us our cam, our rough ridge here before it went into the cam mill or Melling lathe, locating from that pin. That would put it in position to clean up properly.

Q. Then after drilling that hole, what was the next thing that you did? A. It went into the cam lathe.

Q. Did you perform any operation on it? A. Pardon? Yes. When we had the straightening job after this bottom cam and recess here, we had to straighten that.

Q. What was the purpose or function of that straightening operation? A. We used to go after these pretty rough and sprung this shaft out of line. We had a steady rest here and on the centers here and we would throw that shaft out 16 or ninety-thousandths and straighten that out to get the bottom cams running true to line it up properly for your cam mill or Melling lathes.

Q. Did that have anything to do with the operation as performed in the Melling lathe? Was it in any way necessary or unnecessary? A. You had to line this up or too many cams didn't clean up.

Q. After that operation of straightening was performed on those **(484)** shafts it is ready then for the turning operation? A. That is right.

Q. That was the A shaft? A. Yes.

Q. Was that practice followed all during your time as foreman? A. As far as I know, yes.

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(487) VICTOR F. MARENTETTE, a witness called on behalf of the Defendant, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. Your name, please? A. Victor Marentette.

(488) Q. And where do you live, Mr. Marentette? A. 12731 Lauder.

Q. That is where? A. On the West Side.

Q. Detroit? A. Yes, sir.

Q. You are employed by the Ford Motor Company? A. Yes, sir.

Q. How long have you been employed by them, Mr. Marentette? A. 26 years.

Q. What are your present duties at the Ford Company? A. I am a lay-out man on floor space and so on in the time study department.

Q. You are in the time study department? A. Yes, sir.

Q. Under Mr. Klopsic? A. Yes, sir.

Q. How long have you been doing time study work at the Ford plant? A. Approximately 8 or 9 years.

Q. Did you ever do any time study work at the Highland Park plant of the Ford Company? A. Yes, sir.

Q. When did you start doing that work at the Highland Park plant? A. It must have been around 1916 to 1915.

Q. How long did you continue to do that work there? A. Until I was transferred to the Rouge plant, which I think was in 1925, 1924 or 1925.

Q. Now, in the time study work that you did at the Highland Park plant, did you make those time studies with the aid of a stop-watch **(489)** or not? A. Yes, sir.

Q. You used a stop-watch on all time studies? A. Yes, sir.

Q. Do you have any present recollection of having made any time study on the cam shafts? A. Yes, sir; I made the time studies running from the Series A until the last one I made up, which I believe nine changes were made, eight or nine changes were made on that cam shaft, and I was the one that made those changes.

Q. And I show you a certain original here that is marked Exhibit N, and ask you if you can tell what that is? A. Well, this was the change that I made in respect to the 12th and 13th operation.

Q. What is that? Is that a time study or what? A. It was time study, yes, sir.

Q. By whom was it made, do you know? A. By me.

Q. Now, I call your attention to the initials V. F. M. on the 2nd sheet of that, and ask you what is the meaning of those initials? A. That meant that we had to sign all operation sheets with our own initials.

Q. What do the initials V. F. M. stand for? A. Victor F. Marentette.

Q. That is yourself? A. Yes, sir.

Q. How about the time appearing on that? First let me ask you this: Did you make the time study Exhibit N? Was that made **(490)** by you personally? A. Yes, sir.

Q. Now, was that time study made by you with a stop-watch or was it merely by talking to the foreman, the operators and getting the times? A. That was made by a stop-watch.

Q. What was your practice in making time studies with a stop-watch? How long did you observe the job? A. I should judge approximately 2 hours at that time that I made this change in this straightening operation and the turning, turn cam on the lathe.

Q. Do you know anything about the type of machine that was used for turning the cam? A. That was the Walcott machine.

Q. What operation is that on your time study there? A. That is operation 13.

Q. Now, as to the date appearing, 10-8-24, did you have anything to do with the placing of that date on there? A. Yes, sir; any time we made a change on an operation sheet we put the date on, the day it was changed.

Q. That date was put on there by you 10-8-24, on the 8th day of October, 1924? A. Yes, sir.

Q. Now, what is the meaning of the inscription "Series I," or "1"? A. That is Series I. We started on the alphabet, A, to whatever change we had in the previous operation, whatever change we made, it is a transposition of the operation of whatever we made the change on. It is hard to tell. May be additional (491) operations, or probably minus an operation.

Q. I show you a notebook that was introduced in evidence here as Exhibit L, and will ask you if you ever seen that book? A. No, sir; I never seen that book.

Q. Now, will you refer to the pages that are marked L-1, and state whether or not you recognize that information contained there on those pages? A. The shape cams on operation 12 is the only thing I can see.

Q. Will you compare the various things stated here in these notes with your operation sheet Exhibit N? You might as you go along, Mr. Marentette, just read out those things? A. You want the operation read out? Cut to length, .12, .48.

Q. You find it is on both Exhibit N and sheets Exhibit L? A. Yes, sir. Straighten forge 1.24. He has got heat and forge, 1.24. Cold trim, .48. Air heat, 1.72. A snag at 2.22. Center both ends at .2. Rough-straighten, .8 and rough turn center bearing .666. Turn between cams, .75. Straddle face flange, .60. Rough turn gear box, .60. Drill letter L, .24. Rough turn end bearings, .60. Rough grind center bearing, .333 and straighten—I have

a straightening operation of .5 and they don't show a .5 here. It is a shape cams.

Q. What is operation straighten on your time sheet, Exhibit N, what is the number of that? A. No. 12.

Q. Now, as you were reading those and comparing those, do you find the same designation as far as letter or number of each operation is concerned on each? A. That is O.K., outside of this operation here.

Q. What operation number? **(492)** A. Operation 12.

Q. Operation 12 in Exhibit L is what? A. Exhibit L is shape cams .120.

Q. And operation 12? A. On my sheet is straighten. That was the added operation.

Q. And the time given for that is .5? A. .5.

Q. Now, are you familiar with those operations that are described on those two records? A. Yes, sir.

Q. Now, what is operation 12 on Exhibit L? You just read that it is shape cams. A. Shape cams.

Q. And operation 12? A. Here is straighten.

Q. How about operation 13? A. 13 was to turn cam lathe.

Q. That is on Exhibit N? A. On Exhibit N.

Q. And is there a corresponding operation in Exhibit L? A. Shape cams here.

Q. What is the time for it? A. I have .86 against 1.20.

Q. How do you remember what the operation is? Let me put it this way: What was the operation that is designated by "shape cams" on Exhibit L? What type of machine was that operation performed on, if you know? A. That was a shaper.

Q. And what machine was the operation performed on in No. 13 on **(493)** your Exhibit N? A. That was a Walcott machine.

Q. Walcott? A. Of the type of machine of Walcott grinder.

Q. Grinder or lathe? A. Walcott lathe.

Q. Now, referring to the first set of operations, A, B, C and D on these 2 sheets, in what department was that operation performed? A. That was in the forge shop, in the D department.

Q. And how about the operations numbered 1 and 2? A. They were heat-treating operations.

Q. What department was that in? A. 819.

Q. As to the remaining operations, what department were they in? A. They were in Department 410.

Q. All in Department 410? A. Yes, sir.

Q. Now, will you compare the remaining operations on these two sheets. First will you state how many, what is the total number of operations contained in Exhibit M which contains the same information that is contained in Exhibit L-1? A. You mean the remaining operations?

Q. First what are the total number of operations listed on Exhibit M? A. Exhibit N is 46.

Q. No, this is Exhibit M. A. Is that the one you wanted? Exhibit M was 45.

(494) Q. Now, so far as this Exhibit L-1 is concerned, how many operations were listed there? A. Exhibit L-1, 45. The same as this one.

Q. How about Exhibit N, how many operations? A. Exhibit N, we had 46, with the added operation of straightening.

Q. Will you briefly compare, and you might use for convenience Exhibit M, because it is easier to read, the remaining operations after operation 12, shape cams, on Exhibit N, and the remaining operations after 13, turn cam lathe, on Exhibit N. A. Comparing the 2 sheets, is it?

Q. Yes. A. The 14th operation on Exhibit N is cyanide and quench and the 13th on Exhibit M is cyanide. Naturally that would go up an operation, adding this one on Exhibit N of straightening. That would throw this operation sheet off.

Q. You mean changes the number of operations? A. Yes.

Q. Operation "cyanide" from 13 on this sheet to 14 on yours? A. Yes, sir.

Q. Without going over all of them, will you just check briefly the times? A. Do you want me to call them out?

Q. No. Now, can you state, Mr. Marentette, whether or not the record such as contained on this Exhibit M was prepared from a time study of yours? A. I wouldn't be a bit surprised but what it does.

Q. Exhibit M and Exhibit L? A. Yes, sir. Just a moment.

(495) Q. Is there anything on that that would enable you to identify it as a time study?

Mr. Spohn: Just a moment. What exhibits are you referring to?

Mr. Farley: Exhibits L and M.

Mr. Spohn: Both of them?

Mr. Farley: Yes.

Mr. Spohn: I ask the question be divided. The witness testified he never saw the Exhibit L until today.

The Master: I should think if anything the question should be restricted to Exhibit L, rather than M. L is a copy.

A. Exhibit L I will say I never seen before.

(496) The Master: Would you examine Exhibit L and see if there is anything there to cause you to say it was a time study prepared by yourself or not?

A. I don't know of any comparisons here.

The Master: You don't know who the time study was originally prepared by?

A. This was originally prepared by me.

The Master: Exhibit L?

A. But this I don't know anything about.

Q. You are referring to the particular writing here in the book. You mean you didn't write that in the book? A. No, sir; I did not.

Q. My question was this, by looking at the operations listed and the times given for the operations, can you state from examining that whether it was prepared from a time study of your department? A. Well, that I can't say. The cost seems to be approximately the same all the way through, and who did this I don't know.

Q. You mean who made the writing? A. Who made the writing I couldn't say.

Q. Were you the only time study man at the Highland Park plant in and around about 1923 or 1924? A. Yes, sir.

Q. Do you know a man by the name of Spencer Libby? A. Yes, sir.

Q. Do you remember when he was a foreman of the department there? A. Yes, sir; he was a foreman of the department at the time I took the study.

(497) Q. Where would Libby or any other foreman of the department get such information as contained in the first six operations listed?

Mr. Spohn: Well, just a moment now. Objected to as incompetent, irrelevant and immaterial. How would this witness know?

The Master: I don't know how he can unless he is familiar with all the possible sources of obtaining such information at the Ford plant.

A. I am.

The Master: You are?

A. Yes, sir. I know just about how they would go after this to get it. They would refer to our sheets to get that.

The Master: Is there any other place at the Ford plant to get such information?

A. No, sir.

The Master: I will overrule the objection then.

Q. Just one other question. You stated you were removed from the Highland Park plant to the Rouge plant in 1925. What work were you assigned to at the Rouge plant when you were sent there in 1925? A. I was time studying, sir.

Q. Do you know when the time study department at the Rouge plant was started under Mr. Klopsic? A. That I can't just say. I was on production in Highland Park at the time I was taken into the Rouge plant, and I don't know the exact time.

Q. Let me get this straight. When you were transferred from the (498) Highland Park plant you say you were on production? A. Yes, sir.

Q. You mean you were working on production in Highland Park? A. Yes, sir.

Q. And just what do you mean by working on production? Trying to push work out? A. No, sir; I was working production. I was transferred out of the office on to production.

The Master: You mean you were actually on the line?

A. Yes, sir; building tops.

Q. Oh, I see. Then you were transferred to the Rouge and you continued on production work? A. No, sir; I continued on time study work.

Q. You were then transferred back to time study work? A. Yes, sir.

Q. Under whose supervision? A. Mike Klopsic.

The Master: What year were you transferred back to time study work?

A. I think it was in 1925.

The Master: Was Mike Klopsic head of the department then?

A. About five or six months before I came in.

Q. At any rate when you were transferred then from Highland Park to the Rouge you were assigned to work under Mike Klopsic? A. Yes, sir.

Q. What is your usual practice, Mr. Marentette, or what was your usual practice, if there has been any change in 1924, and let **(499)** us say even at the present time. Suppose a company gets in a line of new production machinery, something they haven't used for some time, or never used before to change operations around, do you make a time study of that job immediately after the machines come in, or do you wait? A. We wait a certain length of time until the machine has produced certain parts, and then we take a time study.

Q. You endeavor to wait until they have got the machines operating? A. Yes, sir.

Q. And operating efficiently? A. Yes, sir.

Q. You don't make those time studies immediately after? A. No, sir; we do not.

Mr. Farley: I think that is all.

Cross Examination by Mr. Spohn.

Q. You have been on time study work eight or nine years? A. Approximately.

Q. And most of that was in the Highland Park plant? A. Yes, sir.

Q. You are not on time study work now, are you? A. No, sir.

Q. And you haven't been for some time? A. Well, approximately three years.

Q. As far as this Exhibit L is concerned, that is, that notebook there— A. This notebook, yes, sir.

(500) Q. So far as your information goes that may have been copied from a time study made by you at any time? A. Made by me.

Q. And any operations left out of it they wanted to be left out? A. Yes. I wouldn't say to that because I don't know what they would do. Those are available, if they had those books.

Q. Will you look at Exhibit N and look at the note at the bottom of it? A. Yes, sir; "Operation 12 and 13 H list transposed."

Q. What is the H list? A. The H list was the previous list to I.

Q. What does that note mean? A. Well, it means that the transposition of operations, possibly they were doing one operation where they should have done it ahead of another, or possibly behind the other.

Q. But both operations were in the H list? A. With the exception of the straightening operation.

Q. On your notes you see operations 12 and 13? A. That was the previous operation sheet from this one.

Q. Yes. A. Yes, sir.

Q. And operations 12 and 13? A. 12 and 13 of the H list.

Q. Transposed, that is, one put ahead of the other? A. Or probably the other way around.

Q. Operations 12 and 13 on the H list then would be the turning and straightening? A. 12 on the H list might be—

(501) Q. 13? A. 13 on the opposite list, or the other way.

Q. Exhibit N. A. That is the idea.

Q. And 13 on Exhibit N may have been 12 on the H list? A. It might be that way.

Q. Just transposed? A. I don't remember what the operations were at that time.

Q. You just transposed the operations in Exhibit N? A. Yes, sir.

Q. Both operations were in both lists? A. Yes, sir.

* * * * *

(503) Mr. Farley: I should have offered Exhibit N while the witness was here, the time study of October 8, 1924, photostatic copy of which is attached to Defendant's statement of account as Exhibit 14. I make the offer, if your Honor please, of both Exhibit 14, which is a photostatic copy of the other.

The Master: Well, I will admit the exhibit in evidence. Do you want to object?

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(522) A. M. Wibel was thereupon recalled as a witness and, being previously duly sworn, testified as follows:

Re-Direct Examination by Mr. Farley.

* * * * *

(551) Q. (By Mr. Farley, continuing): In connection with these Walcott machines, did you ever make, have made, any particular study to determine how the machines were operating? A. Yes, sir.

Q. And will you please state what that was that you did in that connection? A. Well, those machines were in use for a considerable length of **(552)** time. The equipment was new to a certain extent, anyway, to our operations, and in nearly every case an important machine of that kind we send an engineer to specifically check over that group of machines, what it is doing each week, and any one of the engineers in his department may be assigned to that particular kind of work. And that was done in this particular instance.

Q. Now, you say that was done in that particular instance? A. Yes, sir.

Q. Now, then, I show you a number of photostatic copies entitled, "Mr. A. M. Wibel, report on Melling cam shapers, week of August 11 to August 17, 1924." Is that what you had reference to when you said that that was what was done in this particular instance (handing exhibit to the witness)? A. This is a copy, a photostatic copy of such a report run week by week.

Q. Was that the report that was authorized by you? A. Yes, sir.

Mr. Farley: I might state that the copies of those have already been introduced in evidence, they are marked Exhibits W-1 to W-14, inclusive. I don't know whether you have copies of them, your Honor.

The Master: No, I don't.

Mr. Spohn: They haven't been introduced.

Mr. Farley: They have been marked for identification, rather.

(The witness handed exhibit to the Master.)

A. In explaining one of these recap sheets, this one that I have **(553)** in my hand, dated 8/18/24, shows the brass tag number of the machines in question. And, on each one of those machines for that week, it shows the number of pieces that the machine is assigned to that it produces, and then it shows the number of hours run for each machine for that week. And then it cites the machine trouble they had for that week on each machine. That is, in hours and the number of tools and the amount of, and the stock and the number of the operations. Now, these are the hours lost due to all of those different things.

You see, in this case here, the operator was absent. That would have to do with it also, and the various other things that apply to that that are under those headings.

And then the recap here to the right end under "Remarks" shows broken tools, and so on. Those are all recapped. And then you take it week after week, and on the final sheet, the whole number of weeks are totalled, and your conclusion as to the fitness of that machine for a particular operation is drawn from that sort of recap.

Q. (By Mr. Farley): I notice that the sheets have the name Payne on there. Who is Payne, if you know? A. He was one of our employees working through the machinery division at that time.

Q. And I notice on the first sheet in longhand, that is Exhibit W-2 the word Payne—Figure a percent efficiency —Wibel—is that in your handwriting? A. Yes, sir.

Q. And did you authorize this engineer, Payne, or employee, to make the survey of this particular operation? **(554)** A. I did, yes, sir.

Q. Do you recall any of the facts in connection with your reasons for ordering this survey? Had anyone called to your attention any particular difficulties you were having

with the machine? A. When we have machines assigned to operations we have our shop men continually contacting these machines, and when trouble is reported, they weren't coming up to expectations, and in order to let it rest, we put a special checking operation or checking sheet such as we have shown here, until something different sets up.

Q. Now, this series of reports gives, I think there were ten weeks' study of those machines, and that study is shown on each of the pages, including a check as to the actual number of hours run, and the machine trouble, and all of that sort of thing; now, in connection with this notation, "Payne, Figure a percent of efficiency." That was a direction by you to Mr. Payne to give you some sort of a figure on the percentage of efficiency, is that correct? A. That was to give a resume of the complete set of facts so that we could get some idea as to what we could consider the efficiency of that machine.

Q. Now, I wish you would look at the last sheet, Mr. Wibel, which is marked Exhibit W. I can't make out whether that is 14, or 19.

Mr. Spohn: 14.

Q. (Continuing): W-14. And I see on there in longhand about "Sixty percent no good." In whose handwriting is that notation? A. That is my handwriting.

(555) Q. Now, will you please explain to the Court just about how you arrived at the figure of 60 percent? I notice that in the first column you have, "Hours run: 50.7." In the last column, next to the last column, "No stock" is 6.3; and, in the next, in the very last column at the right—6.7. Are those figures, 50.7 and 6.3 and 6.7, are experiencing trouble percentages, are they not? A. They are, and the computation by me was evidently made by me in about this manner. I looked at the 50.7 and 6.3 and 6.7, and gave the machine the credit of the last two, and said that the machine was about 60 percent efficient as far as the machine ran. We blamed that on the stock and the operator, and any time the operator might have been absent due to some behaviour of the machine.

* * * * *

(556) Q. Well, I have here in front of me a number of photostatic copies of inventory cards relating to the

shapers (handing copies to the witness), and I ask you to refer to them and notice that this particular one (indicating), shows the—now, let's see— A. (Interrupting): Well, the first machine bearing factory serial **(557)** number or brass tag number, as we call it, was 7089, and that machine was installed on 10/26/14.

Q. So, those machines, if they had been in use, then, at that time, let us say, 10 years when the Model T, or Walcott machines were ordered for the Model T, would that be about right? A. Yes, sir.

Q. Subject to whatever—we won't take the time to check them now—subject, however, to dates of later acquisition, as might appear from the permanent inventory records? A. Yes, sir.

Q. What would be your experience there, Mr. Wibel, concerning these shapers, which already had been in use in the plant of the company for, let us say, a period of eight, ten years; would those machines be expected to run very many more years, or had they about outlived their usefulness, or what would be the facts there? A. It would all depend upon the policy of your company as to maintenance. They would be very badly worn in most cases; because some types of machines, maintenance, can't always keep repairing the parts that are badly worn. But, as a rule, we would consider a machine 10 years old or even 8 years old, an old machine.

Q. Well, that, so that at the time the order for the Walcott machines was given, some of the shapers needed replacement? A. That would be the ordinary procedure and the ordinary conclusion that we would draw.

Q. Do you know of any reason why, Mr. Wibel, why the shapers were not used by the Ford Company in the production of the Fordson camshafts? **(558)** A. Well, the production of the Fordson camshafts was low. It was a type of thing that might not necessarily have the same equipment in every case. Those operations didn't parallel each other 100 percent. Even some of the boring operations, and some of the other operations were slightly different. Just what the reasoning was of the original tractor installation, I don't recall all the facts about that now.

Q. Well, what were the facts insofar as the tractor and Model T cars being prepared or machined in the same de-

partments of the Ford Motor Company at that time? I mean, was tractor production under the supervision and control of the same shop supervisors and executives, or were they entirely separate? A. Well, as I recall, the shop supervision is different.

Q. And up to the time that the Model T production stuff was moving from Highland Park, it was still—the production was located in two different plants, wasn't it? A. One in the Rouge plant, and the tractor at the Rouge plant, and the Model T at the Highland Park plant.

Q. And was it ever called to your attention, at any time, Mr. Wibel, the relative or comparative cost between the production of Model T shafts on the camshaft shapers as compared to the cost of producing those on the Walcott machines? A. It might have been called to my attention. I don't recall the incident especially or where that particular thing was.

Q. When, if ever, did you ever learn that it might have cost you more to produce those camshafts on the Model T, on the Walcott machines and the shapers? A. Well—

Mr. Spohn: Now, if your Honor please, that is a pretty (559) leading question. In view of the witness' answer to the last question, it is fairly leading.

The Master: Well, I think I will let it stand.

A. The circumstances that would come up when we would check up the equipment, that is, we would have our engineers, the different supervisions and the handling of the machining of the tractor camshafts and the Model T camshafts, they would check both operations, and we, of course, knew how the tractor camshafts were machined at that time, and we would draw a conclusion from that, and the conclusion we would draw was that the camshaft as machined by the tractor division was much more expensive.

Q. I wasn't thinking of a comparison of the cost of machining the tractor camshaft and the Model T camshaft. I have in mind, and my question was, did it cost—do you know whether it cost you any more money, or was it ever called to your attention during the operation of the Walcott machines, that those machines were either more costly to operate than the shaper operation had been, or less costly than the shaper machine has been? A. I don't recall any comparison made like that.

Q. Were you familiar with the operations that were required when the shapers were used to prepare the shaft for the shaper operation, in a general way? A. In a general way, yes. There would be forging and going through the forging operations.

Q. Do you happen to know whether immediately prior to changing it, whether there was any distinction between the preparing of the shaft for the shaper and preparing the shaft for the Walcott **(560)** machines, as to whether there was any difference required or any different operations required? A. Insofar as what we knew at the time the Walcott machines were ordered, I am sure we didn't consider any difference in the work to the machine.

Q. Yes.

The Master: Well, do you know if there is any difference in the practice?

A. I do know there was a difference.

Q. (By Mr. Farley): And what was that? A. It was necessary to follow the Walcott operation up with a straightening machine before—

The Master (Interposing): Why? Do you know?

A. Due to the manner in which the machine handled the work. It is quite often that forgings are off to a certain extent, and in order to take certain types of operations you have to straighten them, and it is usually done with a small arbor press, or a punch press.

The Master: You say that was not necessary with the use of a Ford shaper?

A. No, sir, it was not.

The Master: Well, if you had a shaft that was slightly bent in using the shaper, wouldn't that affect the shaper, the shape of the cams obtained?

A. It would all depend on the manner in which the camshaft was held, and the action of the tools. Two machines might act entirely different in that regard.

The Master: Well, the shaper—are the tools of a uniform **(561)** height above—well, the ground, shall I say—as they are going across the shaft?

A. In the case of the shaper, it was a shaper cut just moving across, a different kind of cut than what was used with the Walcott machine.

The Master: Well, if the—because of the fact that the shaft was slightly bent, some of the cams were of a greater height than the others, wouldn't that result in those cams that were of a greater height to be cutting down more than others?

A. It would. But that is of a very common characteristic of forged parts. Forging die, to start with, is new, and the forgings come out much more perfect, and as the die wears, that might cause inaccuracy or a little opening of the piece itself might cause a little inaccuracy, but that might be handled very easily by the shaping machine, and was.

The Master: Well, I am wondering whether or not you are sufficiently familiar with the operation of a shaper just to know why it was unnecessary on a shaper?

A. Well, it has been a long time since I inspected those machines. But, as I recall it, the type of operation was entirely different in that the type of machine as to its solidity and the holding of the work. I can visualize myself that it might very easily take a straightening operation on the Walcott machine.

The Master: Well, as far as you can testify, you simply can state that from your knowledge of the operations that no straightening operation was used in the Ford shaper, but you (562) can't explain why, from the mechanics of the machine, it was unnecessary to have a straightening machine for sprung or bent shafts than was necessary on the Walcott?

A. I think I have explained that to your Honor. It is the way the shaper cuts across the cam on the camshaft.

Q. (By Mr. Farley): Do you know what the relative speeds of rotation of the work shaft and the shaper would be as compared with the speed and rotation of the shaft lathe, which one turned the faster, fast or slow, do you recall any of those details? A. I don't recall exactly, but I would say from memory that the rotation of the shaft in the shaper was slower.

Q. Very slow? A. I think so.

Q. Would that be a factor and necessity for a straightening operation? A. It would be a factor, but from my own opinion it wouldn't be as an important factor as the ones I have mentioned. I think it would be quite a factor also.

The Master: When you found that the Walcott machines did not live up to the guarantee that was made on them and the expectations, did you give any consideration to replacing them with shapers when they became worn?

A. We might have done so. I don't recall exactly what our reasoning was at that time.

The Master: How long before the purchase of these 16, the second series of 16 machines were the three original ones purchased?

A. I believe we purchased the first two in January, and the date **(563)** of the 16 were just a short time after—4/1/24.

The Master: Do you know whether you made any studies on the operations of the first three machines as distinct from the other 16, before you purchased them?

A. Yes, sir. We didn't make studies, however, as we did on the later use of the operations, or machines, because the time element didn't permit that.

The Master: In spite of the studies you did make, however, you did conclude that it would be wise to purchase 16 more of that type of machine?

A. Yes, sir.

Q. (By Mr. Farley): Mr. Wibel, can you state whether or not the Ford Company maintains any particular department for the design, construction or modification of its production machinery, either new or existing? A. It does, yes, sir.

Q. And how large a department of that type do you have? A. I don't know the exact number of men in the department, but it is a large part of our operations.

Q. Who is in charge of that department? A. Mr. Pioch.

Q. And do they in that department design new machinery from time to time in any quantity? A. Design new machinery, I would say, as a general rule, when we feel that the market does not give us the type of and kind of equipment that we need for a particular operation.

Q. You are one of the Ford executives, are you not, Mr. Wibel, who regularly meet with the other principal executives in the offices **(564)** of the company each day for luncheon, and have a discussion of matters of general business of the company with respect to all sorts of activities of the company, isn't that true? A. Yes, sir.

Q. Do you know anything, as a result of your conferences there, and your regular duties, whether the company does from time to time design new machinery and put it in operation? You know that to be a fact from your own department, don't you? A. I know it from my own department. I know it from contacts with other departments, and I know it from contacts with our executives.

Q. Now, do you ever, in connection with your general management and operations of the Ford Company, consider changing any of the parts of the car in order to facilitate production methods? A. Quite often.

Q. As the head of the purchasing department of the Ford Company and as charged with the responsibility of buying the particular Walcott machines, would you have purchased those machines in 1924 if you had known at that time that there was any question that those machines here would be charged with an infringement of a patent?

* * * * *

(565) A. I say we would not have purchased the machines for us at that time.

Q. Do you regularly consider such matters, Mr. Wibel, in connection with your duties, that is, the question as to whether or not possible infringement might arise? A. We always must bear that point in mind, but the type of our purchase order covers that situation, and we don't always go into every detail. As a matter of fact, I would think that would be an exception.

Q. That is in the purchase of production machinery? A. Yes, sir.

The Master: Well, what do you mean when you say that your purchase order takes care of the situation?

A. Well, purchase order has a patent infringement guarantee clause in it.

(566) The Master: Oh, in other words, you usually deal with responsible sellers, and you expect that if there is any possibility of patent infringement, that in the event that any litigation will arise, the seller will take care of it.

A. If a machine tool manufacturer sells us a tool to do a certain kind of job, we assume that the responsibility of the infringement phase of that is his.

The Master: That is as between you and the seller.

A. That is as between us and the seller, yes, and to further that line of reasoning, our orders are prepared like that.

The Master: But, except in a very exceptional case, you make no independent investigation to determine whether or not the particular machine that is being sold to you may be constituting an infringement of, or the use of such machine may infringe an existing patent?

A. I would say that to make a detailed search into the patent would be an exception. We assume that the machine can be sold and used in the regular business procedure when the man approaches us to sell it, that is a responsible company in doing so.

The Master: Well, under what exceptional circumstances do you make an investigation into the infringement?

A. Where a company might have been in litigation or where his financial structure might be in question or where some particular happening had taken place to draw unusual attention to the facts pertaining to a machine tool.

Q. (By Mr. Farley): Is the situation with respect to machine tools different in that respect from a consideration of parts put in the construction that go into the car? **(567)** A. Very considerably different.

Q. Yes. Now, if you knew of a situation, for example, where there had already been some patent litigation or threats of an infringement received by the company

before the purchase of production machinery, is that a question that would have any considerable bearing as to whether or not you would or would not purchase that machine? A. The procedure would be the same practically whether it were production machinery or whether it were maintenance machinery, because, after all, one depends on the other, because as far as the patent phase of the situation is concerned—

Q. (Interposing): Well, my question is directed, not so much as to the type of machinery, but as to the proposition as to what it would be insofar as the purchase is concerned; if you knew there was a possibility of patent difficulties because of the purchases? A. We would be more concerned, I believe, if I understand your question correctly, with reference to the production machinery because the production machinery involves so much more responsibility. It has to do in many cases with millions of parts.

Q. Yes. My question is directed to this: Have you had any reason to talk over patent difficulties with a purchaser for any purpose whatever, whether it was production, maintenance, or whatever it may be; would that have any influence at all in determining whether or not you would purchase the machine? A. It certainly would, yes.

The Master: Did you have any dealings with the Walcott Company before they sold you these machines?

(568) A. I don't recall whether we did or not.

The Master: Did you know whether it was a financially responsible company?

A. We assumed that it was.

The Master: Did you make any investigation or inquiry to determine that?

A. Only in the regular way; his reputation, and we didn't have any special investigation.

The Master: Did you suppose that it had substantial assets, that it was a large company?

A. I don't think we considered it a large company.

Q. (By Mr. Farley, continuing): Now, since you have been in charge of the purchase, director of purchases of the Ford Company, and let's see, prior to that time, in

charge of what is now Kellogg's department—for how many years has it been, Mr. Wibel, that you had been connected with the purchase of production machinery for the Ford Company? Some 20 years or more, is it? A. The purchase of production machinery with Ford Company still passes through my hands.

Q. Yes, but how far back does that experience go? A. 27 years.

Q. 27 years? A. Yes, approximately 27 years.

Q. And, throughout all that experience you have had, I assume, a great many machines, probably thousands of machines called to your attention by manufacturers of machine tools for sale to the Ford Company, is that correct? A. Yes, sir.

Q. Do you know of any instance where the builder of any machine tool, **(569)** offering that machine for sale to the Ford Company, had offered it on the basis of the company paying to the builder a sum of so much per piece for each piece turned out on the machine? A. There may have been instances where that sort of thing was offered, but I certainly don't recall them, as they certainly were not common.

Q. Would you, as the director of purchases for the Ford Company, recommend to the company in any event that they purchase a machine for which they would have to pay so much per piece for the use of the machine during the time the company was using it? A. I would not.

Q. Then, how do you purchase machinery which you do use for production purposes. I mean on a lump sum basis or how? A. The representative of the particular machine tool represents what he can do, and we use our own judgment as to whether the proposition he has made is one that we wish to take advantage of, and if the machinery is satisfactory, it is paid for, and it goes into our regular line of equipment.

Q. Now, are you sufficiently acquainted with the general policy which prevails in not only—let us say, in the machine tool industry, in connection with that sort of a set-up, whether machines are sold as a general policy on a lump sum purchase price or on a basis of a continuing sum to be paid every time the machine turned out a piece of work?

Mr. Spohn: Now just answer that question yes or no.

A. Yes.

Mr. Spohn: I object to that as incompetent, irrelevant and immaterial.

(570) Mr. Farley: Again, in view of the objection, I will ask counsel if he will stipulate here that the plaintiff here is making no claim or pretense that under any circumstances there could be a reasonable royalty of so much per piece turned out by these machines, turned out by the Ford Motor Company. If it will be so, I will withdraw the question. Otherwise, the objection is just as unsound as the other.

Mr. Spohn: Is the other one unsound?

Mr. Farley: Decidedly.

The Master: Read back the question.

Mr. Spohn: I will stand on my objection, your Honor.

(The question was read by the reporter.)

Mr. Spohn: If your Honor please, the objection goes to the fact that we are not dealing here, not with the question of custom; we are dealing here with the question of profits.

Mr. Farley: Might I suggest, Mr. Spohn, that you read the cases dealing with reasonable royalty.

I am quite sure that your Honor, with your readings, is very familiar with the doctrine that reasonable royalty is the amount that reasonable business men called upon, meeting one another, free to deal with one another, would adopt in connection with this, or a similar transaction.

Now, if a reasonable business man in an industry never followed such policy, how can the claim of reasonable royalty here be in the slightest degree reasonable if there is something that no one has ever heard of in any industry.

Mr. Spohn: If your Honor please, if that is counsel's position as to the law in this case, simply because automobile **(571)** manufacturers may not have paid royalties—

Mr. Farley: (Interposing): I am speaking of machine tool industry.

Mr. Spohn: I am sorry. Machine tool industry —that that prevents this Court from hearing that question.

Mr. Farley: I don't think there is any necessity of any further argument.

Mr. Spohn: I stand on the objection.

The Master: I will overrule the objection. The answer may be taken.

Mr. Spohn: Now, will you read the question again, Mr. Reporter.

(The question was repeated by the reporter.)

A. I am.

Q. (By Mr. Farley): Are they sold? A. Sold as a machine tool with no relation made to the royalty phase of the situation at all.

Q. Yes. Now, the same question with respect to the automobile industry.

Mr. Spohn: Same objection.

The Master: Same ruling. I will hear the testimony.

A. I would say that it is even more applicable to the automobile industry.

Q. That no one buys machinery on the basis of paying so much per piece for each piece a machine turns out? A. That is right.

The Master: With what other industries are you familiar with the custom in purchasing machine tools.

(572) A. I am familiar with the machine tool builders and the manner in which they sell their machines.

Mr. Farley: You see, the machine tool business, your Honor please, are the type of people that make machinery for production purposes and sell it to the automobile industry and builders of ships and all sorts of things. That is what we call machine tools, shapers, planers, tools like that. It is a very, very extensive industry.

Q. (By Mr. Farley): Now, Mr. Wibel, there have been certain statements of account and computations filed in this case. Plaintiffs have filed a statement in which it is purported to show that by the operation of these Walcott ma-

chines, the Ford Company made very large and substantial profits. That computation is based on the assumption almost entirely on the assumption, with the exception of a comparatively small manufacture—well, manufacture of a few million, I will say, Model T shafts, that if the Ford Company had not purchased these Walcott machines in 1924, they would have had to employ Landis grinders for the manufacture of over four million Model A and Model F shafts—do you follow me? A. Yes, sir.

Q. Are you familiar with the Landis grinders? A. Yes, sir.

Q. What would you have to say concerning the proposition that if the Ford Company had not known of these Walcott machines, or had not purchased these Walcott machines, they would have been compelled to machine over four million Model A shafts by the use of Landis grinders? (573) A. I would say that we wouldn't draw that conclusion.

Q. You would say that you wouldn't draw that conclusion? A. I would say that we wouldn't draw that conclusion.

Q. Well, I would like to have you state, Mr. Wibel, if you please, state what the facts are and what your position with respect to that sort of a thing would be, as a man holding an executive position in the Ford Company, and charged with the purchase of production machinery and with some knowledge of the Ford Company's methods of the design and the production and all that sort of thing? A. Had that problem come up before us at that time, we would have immediately checked in all the equipment we had on the job for machining pieces of a like nature which would have been the Model T camshaft, and we would have determined whether there was anything that we could do with that machine that takes the other tractor or the Model A camshaft or whatever the problem might have been at that time; I think that would have been the procedure and it certainly would have been my reasoning at the time.

Q. Would you state what the plausibility would be, or the possibility of the Ford Company employing Landis grinders for the production of Model A camshafts? Would you say that it would be altogether possible you might

have ever resorted to that method of machining those shafts if you did not have the Walcott machines? A. Well, that would be—it might have been possible, but it wouldn't have been probable. We would have considered an extensive manner of doing it in the manner in which we were doing the **(574)** camshafts then.

The Master: What manner are you referring to, by the way?

A. The shaping method.

The Master: You were using the grinders in preparing or processing the tractor camshafts at that time?

A. I believe we were. I think that is right.

* * * * *

(577) Q. And I believe the point was raised by a certain witness that testified in this proceeding here that a shaper was not an efficient machine tool because of the fact that it, like a planer, had an idle stroke, and then a cutting stroke. What would you say about that? A. I would say that is a principle that is recognized in machine tool practicing, and we know it is inefficient, and we don't use it unless the circumstances of the job demand that we use it.

Q. And, nevertheless, thousands of planers and shapers are used with the regular production machines? A. Yes, sir, they are a regular part of the machine tool equipment.

Q. Now, I ask you, Mr. Wibel, do you know what type of equipment is now used by the Ford Company for machining its camshafts? A. We cast our camshafts, and the procedure is, as I recall it, different. We finish grind.

(578) Q. You now no longer use any of those that the industry would call a machining operation? A. We finish the shaft directly from the cast camshaft condition.

Q. And you eliminate all of these operations? A. We have.

Q. Such as turning or milling or shaping? A. Yes.

Q. As were formerly used? A. Yes, sir.

* * * * *

(742) CHARLES GORDON was thereupon recalled as a witness, and having been previously duly sworn, testified further as follows:

CROSS EXAMINATION by Mr. Farley.

Q. Mr. Gordon, you have produced a certain paper which was offered in evidence as Exhibit GG having to do with a release and settlement with the White Motor Company, and which was signed by you as president of the Gordon Form Lathe Company. That is correct, isn't it (handing document to witness)? A. Yes, sir.

Q. You did not, when your testimony was taken concerning that, tell the Court that there was another agreement in addition to that, which was signed by your company with the White Company, did you? A. I don't remember that I did.

Q. Well, there was another agreement between your company and the White Motor Company of which that forms a part, isn't that true? A. I don't remember any other agreement. It is quite possible there was, because—

Q. (Interposing): Are you familiar with the agreement made between your company and the General Motors Company, General Motors Corporation? A. Well, to the extent that I read over all the agreements before I signed them. That would be the only time that I would probably ever see them.

Q. I show you paragraph 8 of Defendant's Exhibit 71, which was introduced in the trial before Judge Tuttle, which purports to be an agreement between the Gordon Form Lathe Company and the (743) General Motors Corporation. I call your attention to paragraph 8 of that agreement which refers to an agreement with the White Motor Company dated February 6, 1930. Now, this particular letter, which was introduced as Exhibit GG, is not the one identified by the agreement dated February 6, 1930, is it? (Indicating.) In other words, paragraph 8 of that agreement appears, if your Honor please, in volume III, pages 1046 to 1049, inclusive. A. White Motor agreement, dated December 21, 1929, appears to carry the same date as this agreement.

Q. That is as Exhibit GG? A. As Exhibit GG, yes.

Mr. Farley: Now, I would like, if your Honor please, to call upon Mr. Gordon and his counsel to produce the White Motor Company agreement dated February 6, 1930. Do you have that in your possession?

Mr. Michael: I don't think it is here. I thought they were both here.

The Master: Will you produce that agreement?

Mr. Michael: Gladly, yes.

Q. (By Mr. Farley, continuing): Are you aware of the fact, Mr. Gordon, that the White Motor Company agreement dated February 6, 1930, contained a paragraph to the effect that neither of the parties to that agreement would use that agreement in connection with any litigation against any other parties based on infringement occurring prior to the date of the agreement?

Mr. Spohn: Objected to as incompetent, irrelevant and **(744)** immaterial; hearsay, if we are going to produce the agreement.

The Master: We will get the agreement, and it speaks for itself.

Mr. Spohn: The agreement will speak for itself.

The Master: You needn't answer that question.

Mr. Farley: Very well. That will be all, Mr. Gordon.

(Witness excused.)

Mr. Farley: I will call Mr. Dahl, please.

THEODORE R. DAHL was thereupon called as a witness on behalf of the Defendant herein, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. What is your name, please? A. Theodore R. Dahl.

Q. Where do you live, Mr. Dahl? A. I live in Cleveland, Ohio. I am some 53 years old. I am a lawyer by profession, finishing the University of Minnesota Law School in 1910. Practiced law in Cleveland some two years, until 1912, and then I went with the White Motor Company

as its office attorney and remained there for 23 years in various capacities, from assistant secretary to executive vice-president, member of the board of directors, and office attorney.

Q. In or around, or about the year 1929, what was your position with the White Motor Company? **(745)** A. The White Motor Company, my official title was Secretary.

Q. And, did you have anything to do with the legal matters arising in the company in connection with the business of the White Motor Company in and around 1929? A. I handled all our legal matters, and had no other legal advisers other than our general counsel downtown.

Q. In connection with those duties, did you have anything at all to do with a certain agreement made by the White Motor Company with the Gordon Form Lathe Company? A. Yes, I handled the settlement; was responsible for it, and determined to make the settlement—

Mr. Spohn: Just a moment. The question was did you have anything to do with it. Will you please answer the question yes or no. I move the rest of the answer be stricken.

A. The answer is "yes."

The Master: I will strike the rest of the answer.

Q. (By Mr. Farley, continuing): Do you know a man by the name of R. M. Cooper? A. He was one—yes.

Q. And who was he? A. He was one of my assistants who handled my patent work.

Q. Was any work done by Mr. Cooper done under your supervision? A. Yes.

Q. When you were Secretary of the White Motor Company in charge of legal matters, did you have anything to do with a settlement made by the White Motor Company with the Gordon Form Lathe Company? A. Yes.

Q. Do you have a present recollection of that particular matter? **(746)** A. I have.

Q. Now, will you recite, as far as you can recall the facts, the facts which led up to that settlement?

Mr. Spohn: Now, just a moment. May I have a preliminary question or two, your Honor, before the witness answers that?

The Master: Go ahead.

Mr. Spohn: Mr. Dahl, are you now connected with the White Motor Company?

A. I am not.

Mr. Spohn: Are you practicing law now?

A. I am not.

Mr. Spohn: And, when did you leave the White Motor Company?

A. October 1, 1935.

Mr. Spohn: And, are you here under subpoena?

A. No.

Mr. Spohn: You are here voluntarily to testify?

A. Right.

Mr. Spohn: Now, if your Honor please, I object to the competency of the witness to testify to any transactions at all concerning the White Motor settlement or its negotiations. The relationship of attorney and client persists. The witness is here voluntarily. No proper background for the giving of this testimony is in the record at this time.

Mr. Farley: Counsel apparently forgets that they called one Howard Jones to testify concerning this matter.

Mr. Spohn: He is not a lawyer.

Mr. Farley: As far as the relationship of attorney and **(747)** client is concerned, my understanding of the law is that that, if there is a confidential relationship, is one which can be invoked only by the persons who are in the confidential capacity. I have never heard of any objection being proper coming from a third party who has no part of the confidential relationship.

Mr. Spohn: Why, if your Honor please, does counsel mean to state that simply because the client isn't before the Court, or isn't a party, that the client's attorney can get on the stand and tell private communications, confidential of nature, between that attorney and the other client when he isn't there even

to offer his objection to it? I never heard of such a thing.

Mr. Farley: When I get to the point of discussing confidential matters, then I think it will be plenty of time for Mr. Spohn to make the objection.

Mr. Spohn: If your Honor please, the confidential communication extends to all of the negotiations with respect to this White agreement.

Mr. Farley: Why did you use it then?

Mr. Spohn: I didn't use it then; I used the agreement.

The Master: Well, to the extent the communications are negotiations between attorney for the White Motor Company and the opposite side of the agreement, the confidential communications which come within the scope of the attorney-client privilege consist of the advice given by the attorney to his client and the things that are said when the client is requesting advice by his counsel. I don't think they **(748)** extend to negotiations with the other side.

Mr. Spohn: But, the question, your Honor, called for all the facts, all the facts.

The Master: The question is so broad it might, if it were fully answered, cover matters which are within the scope of the attorney-client privilege.

Mr. Farley: Might I have a further question or two?

The Master: Go ahead.

Mr. Farley: I think I can dispose of that very quickly.

Q. (By Mr. Farley, continuing): At the time we are speaking about, Mr. Dahl, you were then an officer of the White Motor Company? A. I was.

Q. And you were not merely a lawyer, whom the White Motor Company was your client? A. That is right.

Mr. Spohn: But, you did handle all—may I ask a question on that? We are still under my objection.

The Master: Yes.

Mr. Spohn: These are all preliminary questions.

The Master: That is right, there has been no ruling on the objection yet.

Mr. Spohn: You were the attorney for the company, office attorney for the company, and as you stated you handled all legal matters around 1929 for the company.

A. For the company, correct.

Mr. Spohn: Yes.

Q. (By Mr. Farley, continuing): Now, I would like to call your **(749)** attention, before being called as a witness here, have you had any discussion concerning this matter with Mr. Black, the president of the White Company? A. No.

Q. Have you, before coming here, been granted access to the files of the White Company? A. I have.

Q. And, the White Company are aware of the fact you were going to appear as a witness here? A. That is right.

Q. And, were you placed under any obligation by the White Company not to discuss any of these matters? A. Not in the least.

The Master: Who in the White Company was aware of the fact you were going to appear here as a witness?

A. Off the record may I just tell you?

Mr. Spohn: Not off the record; nothing off the record, no, sir.

The Master: On the record.

A. The president of the company, the secretary of the company, and—no, I am not sure about that; the president of the company and secretary of the company, that is all.

* * * * *

(755) Q. (By Mr. Farley, continuing): As secretary of the White Company at that time, Mr. Dahl, did you have anything to do with that settlement? A. I did.

Q. Will you please state the facts which came to you as secretary of the company which decided you to engage in, or participate in that settlement?

(756) Mr. Spohn: I object to that. It is a privileged communication between attorney and client stating facts.

Mr. Farley: The facts—he is the secretary of the company.

Mr. Spohn: He is the attorney. You can't be an attorney on one hand and secretary on the other, and withdraw from the privilege of attorney and client because you are secretary.

* * * * *

(758) The Master: The witness on the stand testified he was handling this matter in a legal capacity—

Mr. Farley (Interposing): I would like to have the witness state just what the facts are in that connection.

Mr. Spohn: Just all preliminary to the general objection.

Mr. Farley: Yes.

Mr. Spohn: I would like to find that out, too.

Q. (By Mr. Farley, continuing): Will you please state, Mr. Dahl, whether or not your duties in connection with this settlement were those in which the relation of attorney and client existed, or were you acting as an officer of the corporation?

Mr. Spohn: If your Honor please, that is not the facts; that is calling for a conclusion on the part of the witness, whether he is an attorney—

Mr. Farley (Interposing): If that does not call for a fact—he was on the job.

Mr. Spohn: Well, if your Honor please—

The Master: I will overrule the objection.

A. I can answer that question categorically, I believe. I was acting as an officer of the corporation in effecting the settlement. I certainly had to exercise no legal judgment, **(759)** or to base my judgment on no legal experience until after the settlement had been made, and the question of the form of the document setting forth the details of the settlement was submitted to me.

The Master: Well, I will make this ruling. It is certainly true that the privilege is that of the client and not of the opposite side to a lawsuit in which the client is not participating, and the client may waive the privilege either impliedly or expressly, and I think the witness, since we do not have the client present, is the best judge of whether or not the client has made

such a waiver. If the witness thinks he is an attorney, he can testify to communications between himself and the client he was representing, or by whom he was employed, I will permit him to so answer and leave it up to the judgment of the witness as to how far he wants to go on this point.

Mr. Farley: On that, your Honor, I think I should, perhaps, make, and be entitled to make, a statement. After Mr. Jones' testimony was taken, I arranged to have a conference with Mr. Black, the president of the White Motor Company. I had such a conference with him. Mr. Black told me that anything they had in their files, anything with relation to this particular matter, would be turned over to us as freely as possible. Also, it was through Mr. Black I got the name of Mr. Dahl. I questioned Mr. Black concerning the matter and Mr. Black said at that time, "I was not president of the White Corporation; I was not connected with it; I know nothing about it. Mr. Dahl handled all those **(760)** matters and I should see, interview, and talk to him about the thing," and Mr. Black further said that I was to tell Mr. Dahl that he could have full access to the company's files.

The Master: Go ahead, then.

Mr. Farley: Is there a question?

The Reporter (Reading): "Q. Will you please state the facts which came to you as secretary of the company which decided you to engage in, or participate in that settlement?"

A. As an officer of the company I attended all meetings of the board of directors of the National Automobile Chamber of Commerce, of which, in later years, I was a director. At all those meetings reports were made by the Chairman of the Patent Committee to the board of directors in reference to patent matters. At that time for the first time there was called to my attention the Walcott, the Gordon-Walcott case. Later the company received a notice from the Gordon Company advising of certain court decisions, which caused me to immediately contact the Chairman of the National Automobile Chamber of Commerce, and this decision having been made, I considered that it was a matter which the company should attempt to settle.

Q. May I have a question here, Mr. Dahl. In view of the fact that you attended the Board meetings of the Chamber of Commerce at which patent matters were brought to the attention of the Board, had you known that the Chamber of Commerce had taken over the defense of the Walcott case? **(761)** A. I knew that it had taken over the defense, but I don't know at what time I knew it in reference to what I have just said.

Q. Very well, proceed. A. I then called into my office an assistant who handled patent matters for me, a man named Cooper, and had him find out whether we had any of these machines that were alleged to violate a patent, how many, and upon his coming back to report to me he brought with him his superior in the engineering department who was H. D. Church, resulting in a conference between Church, Cooper and myself, in which we discussed our situation, and in which I determined to make an offer of $5,000 to get the thing out of the way. I suppose I ought to probably interpolate and say my principal job with the White Motor Company was really "trouble-shooter," and this was what I considered a rather minor trouble. And, as a result of my instruction to Cooper he wrote a letter, which I suppose speaks for itself, offering a settlement of some $5,000, which offer was refused.

Q. Just a minute, Mr. Dahl. Cooper's letter was introduced in evidence as Exhibit HH. I show you a photostatic copy of it and ask you if that is the letter to which you have reference (handing document to witness)? A. That is it.

Q. Very well. Will you proceed. A. That offer was refused. Meanwhile I was obtaining a good deal of information from the National Automobile Chamber of Commerce in reference to—I am not an engineer and my terminology is probably incorrect—in reference to equipping **(762)** these particular machines we were using with some different kinds of heads, or at least some different kinds of apparatus, which, it was alleged, would avoid the interference with a patent.

I took that matter up through Cooper with the factory, and the production was so slight that they didn't think it was worth doing. We were then either advised by letter or—I think by letter—no, I retract that. Yes, we were advised by letter from the National Automobile

Chamber of Commerce, and I was advised in the directors' meeting, that other suits were about to be brought by the Gordon Company for infringements, and one or two companies' names were mentioned, and the probability was that we would be one of the companies that might be sued. So, again I called Cooper, and in an attempt to avoid suit, asked him to at least try to get a settlement on the machines, which settlement we got of $2,000 a machine, as I recall.

Q. And, that was for the future use of the machines? A. That is my recollection. I would have to refer to the files to be sure of that. But, I wasn't very much interested in the settlement; it wasn't a matter of any particular moment. It was a matter to be gotten away with from as cheaply as possible, and when it comes to details, whether it was before or after, I would have to have an opportunity to refresh my recollection from the White Company files which they delivered to me to take over with me.

All during this time there was quite a ferment among the members of the industry through its meetings in Detroit, and it **(763)** was intimated to us that we probably ought not to settle as a separate company, that we probably ought to wait for the rest of them, but again to avoid suit I told Cooper to go ahead and make the best settlement he could, and as a result we made a settlement, or made a payment of $2,355.00 plus four, something like that—six thousand odd dollars. I think that covers any general statement I could make. I think it is nice of counsel not to object to some of my statements before this.

Q. Now, in connection with that particular payment of six thousand odd dollars, did you as secretary of the White Company take into consideration any question of reasonable royalty?

Mr. Spohn: Objected to as incompetent, irrelevant and immaterial.

The Master: Overruled.

A. I did not.

Q. At the time this settlement was made, did you, in your capacity as an officer of the White Company, have more or less complete authority concerning the question of settlement, or was that a matter about which you had to

particularly refer the matter to someone in a position of greater authority than the position you occupied?

* * * * *

(764) A. I consider that I had complete and final authority to determine the amount of settlement.

Q. (By Mr. Farley, continuing): Now, as to the actual facts, did you or did you not have to consult with anyone as to whether you should not or could make that settlement? A. Well, as a matter of fact, I can probably clear up your question, if you will permit the answer, and that is this, that I did not report it to the board of directors, but that in all matters of this kind we always discussed them with the president of the company, and I, no doubt, told him I expected to or had settled this matter.

Q. Do you know a man by the name of Howard Jones? A. Yes, I know him.

Q. At the time you considered this question of settlement, do you know whether Jones was employed in any executive capacity by the company? A. I know he was not.

Q. And just what were his duties at that time, or his job at the White Company at that time? **(765)** A. If I may be permitted to refresh my recollection of the employment record of the White Company, I will give you his title. (Examining document.) He was shop engineer.

Q. Did you, in connection with your reaching your decision to make the settlement, at any time confer with Howard Jones? A. I never saw him.

Q. Did you know Howard Jones at that time? A. I probably knew him, but it is even questionable whether I knew who he was, but I probably knew him.

Q. You knew of this decision which had been rendered by the Court of Appeals of the Sixth Circuit, did you not, Mr. Dahl, in the case of the Gordon Form Lathe versus Walcott Company? A. I did.

Q. That had been called to your attention? A. It had.

Q. You knew that the Sixth Circuit Court of Appeals had decided that the Walcott machines were an infringement on the Gordon patent? A. Yes.

Q. Will you state whether or not that in any way influenced your decision to make the settlement which you did make? A. Of course it did.

Q. What bearing, if any, would that have had on the matter considering it as an officer of the company having some knowledge of legal matters? A. Why, being a small producer with a very limited output, a specialty plant, not a production plant, and a decision against me as to paying royalties why, would I settle with a **(766)** gun at my head?

Q. Did you consider whether or not the decision in the Walcott case might in the future have been held to be *res adjudicata* against the White Company? A. Read that, please.

(Last question was read by the reporter.)

Mr. Farley: If you don't understand—

Mr. Spohn (Interposing): Just a minute. Just a moment, I think that question is perfectly clear to any lawyer, and won't require any information of counsel in the matter at all.

The Master: Counsel can re-phrase his question. He can withdraw it and ask a second question if he wants to, as long as his second question is perfectly competent.

Mr. Farley: Strike the question.

The Witness: I understand the question. It isn't a question of my understanding it; it is a question of my memory, whether at that time I considered that, and I believe that whether I considered it or not would be determined by a reading of the final contract which we entered into with the Gordon Company, but I don't recall, and I don't want to answer, because I couldn't be perfectly honest in my own mind, and the matter isn't of sufficient importance to me so that I care to trifle with my conscience. That is the truth.

Q. (By Mr. Farley, continuing): There has been some testimony here, and particularly the testimony of Mr. Jones, that part at least of the White Motor Company, was on the basis of ¾ of a cent a cam for past infringement. Will you state whether or not you gave any consideration to that? **(767)** A. I did not, and I can go as far to say that until

I went back to get the White Motor Company files, I didn't know that that had anything to do with it, but I couldn't have helped but have known it, because I saw Cooper's letter stating that ¾ of a cent—stating that the number we had made at ¾ of a cent, plus $2,000 a machine, added up to that amount. It was not at all a question of royalty or reasonableness; it was a question of a settlement of a lawsuit in which there was a court decision against us.

The Master: Well, the Court decision, of course, did not find anything with respect to the profits which —or, royalty, which would be attributable to the machine. It simply found there was an infringement.

A. That may be true, but through the information that was presented to us every month in New York by the Patent Committee to the directors, which meeting I attended, unquestionably three-quarters of a cent must have been what they were talking about because that is the only figure I can remember until I look over again the White Company correspondence and read something about the meetings in New York, or various offices, and what not, that I had completely forgotten about.

* * * * *

(768) Q. (By Mr. Farley, continuing): Will you state whether or not, Mr. Dahl, after you made the settlement with the Gordon Form Lathe Company you received any monies from the General Motors Company with reference to the same matter? A. We did.

Q. I hand you a letter and ask you if you will state, if you know, what that is (handing document to witness)? A. Yes.

Q. And, just what is it, please? A. It is a letter from my assistant, Cooper, addressed to me, bearing my secretary's stamp of receiving it, and handing to me the release and sub-license under the Gordon and Redlin patent, No. 1,542,803, with a pencil notation from my secretary in reference to the payment of a sum of money from General Motors.

Mr. Farley: I ask this be marked as Defendant's Exhibit 232.

(The document above-referred to was thereupon marked Defendant's Exhibit 232 by the reporter.)

Mr. Farley: I will ask the reporter to mark this photostatic copy Exhibit 233.

(The document above-referred to was thereupon marked Defendant's Exhibit 233 by the reporter.)

Q. (By Mr. Farley, continuing): I show you another photostatic copy of a letter, and ask you if you know what this is (handing document to witness)? **(769)** A. I do.

Q. Is there anything particular in that letter which enables you to identify it? If so, will you state what it is. A. My name.

Q. You are now referring to Exhibit 232, and that is a photostatic copy of a letter of the White Motor Company, a departmental communication, written by Mr. Cooper, addressed to Mr. S. G. Crilley, Comptroller. Mr. Cooper there is the man whom you referred to earlier in your testimony as being an assistant of yours? A. That is correct.

Q. And, you are familiar with Mr. Cooper's signature? A. I am.

Q. And you recognize that as being his signature? A. It looks just like it.

Q. Briefly, will you state what that letter is and what it has to do with, and what your recollection is concerning it? A. It is a letter from my assistant to the comptroller requesting him to issue a check for $6,455.92, to the Gordon Form Lathe Company which has been okayed by me for payment.

Q. And would that have been a necessary part of your duties to okay a communication of that type? A. They wouldn't have paid it unless my name was on it.

Q. Now, I refer you again to Exhibit 232, and ask you to refer to the pencil notation there, and state what you know about that (handing document to witness)? A. This is a notation from my secretary advising that we had received this check for $3705.92 from the General Motors Corporation representing the difference between the—I don't **(770)** think that is right—representing the amount that was refunded to us by General Motors to apply against our net cost of settling this case, which made our cost the difference between $6455.92 and $3705.92, which was $2750.00, is my recollection.

Q. $2750.00 being the amount or the cost to the White Motor Company of this settlement? A. That is right.

Q. As far as the release and sub-license under the Gordon and Redlin patent referred to in this communication, I notice it is dated December 17, 1931, did you receive with that further release and sub-license from the General Motors Company? A. We did, or I did.

Mr. Farley: I offer first, Exhibits 232 and 233 in evidence.

Mr. Spohn: No objection.

The Master: They are admitted.

Q. (By Mr. Farley, continuing): Now, Mr. Dahl, when Mr. Howard Jones was produced as a witness at Cleveland, he gave some testimony to the effect that the White Motor Company had paid or were paying 10 cents a shaft royalty for splined shafts. Do you happen to know anything about that? A. That was a Gear Grinding settlement, I believe. We paid 12½ cents for past, and 10 cents for producing, it is my recollection.

Q. Will you state the facts under which that particular settlement was effected? A. Well, there had been a decision against the Studebaker, and it is my recollection it was 15 cents—I don't know enough **(771)** about the patent handling of it to know how 15 cents was arrived at. It is not a decision of the Court, but I guess it is determined by a hearing such as this, by a Master or something like that. In any event, I was up against 15 cents royalty on that thing, and I came over to see Banks of the Gear Grinding Company, and finding him a pretty tough Scotchman, having played golf with him three or four days, and not being able to do very much, I was pretty well satisfied to get any settlement under 15 cents, and my recollection is that I got 12½ for past and 10 cents for future, and I didn't make much in the golf games either.

Q. In so far as that payment of the White Company that was, too, a settlement, as I understand your testimony, which was effected by you; that is, the Gear Grinding? A. It was entirely effected by me, yes.

Q. And, in making that settlement was there any question of reasonable royalty as far as you were concerned? A. There wasn't, and if there had been I wouldn't have been handling it.

Q. As I understand your testimony, that was a settlement made after the Court of Appeals had rendered its decision in the case of Gear Grinding versus Studebaker in which they found a reasonable royalty in that particular case would be 15 cents a shaft? A. The decision.

Q. That is what the decision was? A. Yes, sir.

Q. And you had knowledge of that? A. Yes. I know it was the Studebaker case, but outside of that **(772)** I don't know what district it was in; circuit, or anything like that.

Mr. Farley: I think that is all. You may cross examine.

Mr. Spohn: Your Honor please, may we have just a little recess?

The Master: All right.

Mr. Spohn: Oh, did you have something, Mr. Farley?

Mr. Farley: That is all right. I have just one more question. I will ask it after the recess.

(A recess was thereupon taken.)

Mr. Farley: Just one more question.

Q. (By Mr. Farley, continuing): Do you know a man by the name of George Smith? A. Yes.

Q. And what was his capacity, or was he associated with the White Company at that time, and, if so, in what capacity? A. He was. In various capacities. His last title was vice-president in charge of production. And, previous to that he was technical assistant to the president, and next he was Works Manager, and finally he was the vice-president in charge of production.

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(773) George W. Smith, Jr., was thereupon called as a witness on behalf of the Defendant herein, and having been first duly sworn, testified as follows:

Direct Examination by Mr. Farley.

Q. What is your name, please? A. George W. Smith, Jr.

Q. Where do you live, Mr. Smith? A. Greenwich, Connecticut.

Q. Were you ever connected with the White Motor Company? A. I was connected with the White Motor Company for 14 years in the period beginning with 1913 and ending in 1935.

Q. In what capacity were you employed in the White Motor Company around about December, 1929, and the early part of 1930? A. I was vice-president in charge of production.

Q. And, do you know Mr. Dahl who just testified? A. I do.

Q. And, what was his position with the White Motor Company at that time? A. He was both Secretary of the company and in charge of legal activities.

Q. Did you know anything particularly about this Gordon patent, and the charge of infringement against the White Company? A. I did.

Q. And, did you have anything to do with the settlement of that particular controversy? A. I did not.

Q. As far as a matter of that type was concerned, do you know, **(774)** in the position you were then occupying, under which official of the company such a matter would be referred to? A. I did know.

Q. And to whom would that matter be referred? A. To the Legal Department under Mr. Dahl.

Q. What was your particular knowledge of the situation? A. The amount of money that would be charged to the factory in the settlement of the case.

Q. And, there was a charge of that type made to you, or to your department? A. That is correct.

Q. Do you know Howard Jones? A. I do.

Q. And do you know in what capacity he worked for the company at that time? A. He was shop engineer reporting to Mr. Merton Blank, who in turn reported to me.

Q. And, do you know whether or not it would have been any part of Mr. Jones' duties to make decisions to settle or not to settle that particular charge of infringement? A. It would not have been part of his duties.

Mr. Farley: I think that is all. You may cross examine.

Mr. Spohn: No cross examination.

The Master: Just a minute, would it have been a part of his duties to advise as to the benefits received from the infringing machine?

A. It would have been.

The Master: Do you know whether he was consulted at that **(775)** time in connection with the settlement?

A. He was consulted by the factory as to the implications of this patent in litigation.

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(879) Mr. Farley: If my memory serves me right, if your Honor please, at the conclusion of the sessions Monday night, I renewed the offer of Exhibits L and M. That was the Spencer Libby note book, and the copy that was made, which was marked Exhibit M. When that offer was made originally, after Libby's testimony, I understand the ruling was that the admission of them would be withheld until we had satisfactorily explained the destruction of the original records. I think we did satisfactorily explain that with the witness Klopsic, who testified that as new time sheets were made, the originals were taken back and destroyed.

The Master: I think there is sufficient testimony as to the destruction and also as to the date on which the exhibit was prepared, to make it admissible into evidence. There is some question, of course, as to the exact date of the time study from which it was taken, but I will admit the exhibit into evidence. Do you wish to register an objection?

Mr. Spohn: I do, if your Honor please. I understood at the time your Honor made the original ruling on it, that it was admitted solely for the purpose of detailing the witness' knowledge of the operations, and it was not admitted at all as any evidence on the minute costs set forth therein.

The Master: That is true. I think now, though, with the further proof as to the destruction of the original time studies that it is admissible for the other purpose as well.

(880) Mr. Spohn: I will just note an objection to that. I appreciate your Honor's ruling on that point.

The Master: Yes.

Mr. Spohn: My objection on the point of the minute costs being that the exhibit does not point out with sufficient definiteness, nor did the witness, the time study from which it was taken, if it was taken from a time study, so as to afford any benefit of evidentiary value in this proceedings.

The Master: The witness testified it was taken from the time study that was currently available to him as a foreman and during the year 1923 or '24.

Mr. Spohn: That is right. That was his testimony, your Honor.

The Master: And as foreman, it would be unlikely that he would have copied any time study which was not being used at the time that he was acting as foreman. There would not have been any purpose in doing so. The time study itself may have originally been made a number of years before under the system of the Ford Company, not to revise time studies except where there is a change in operations or a change in part or something which makes them suppose there is a necessity for a change in time that it takes to perform operations. I think that there is some question about the weight to be attached to the exhibit, but I will admit it in evidence.

Mr. Farley: I will call Mr. Aptekar.

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(881) Albert Aptekar was thereupon called as a witness, and being first duly sworn, testified as follows:

Direct Examination by Mr. Farley.

Q. Where do you live, Mr. Aptekar? A. 15803 Normandy, Detroit.

Q. You are employed by the Ford Motor Company? A. Yes, sir.

Q. How long have you been employed by the Ford Motor Company? A. I have been there since March, 1915.

Q. To what department of the company were you assigned when you went there in March, 1915? A. The cam shaft department.

Q. Do you remember what method or machines the Ford Company were using for machining or roughing down the cams of the cam shafts when you went into the com-

pany? A. Yes, sir, I do. They used a Milwaukee mill, set up an attachment on it where they applied three shafts for cutting the cams at one time, with an index head on it.

Q. And that machine was one where the operator machined three shafts at one time? A. That is right.

Q. I show you an exhibit that has been introduced here, Defendant's Exhibit 145, pages 9 and 10 of the publication American Machinist, dated July 3, 1913, and call your attention to Fig. 3, and ask if that machine shown in that figure represents the machine you just testified about? A. That is right, this is the machine.

(882) Q. Now, how long did the company use that type of machine after you went in there? Was it continued to be used during your entire time in the cam shaft department, or did they use something else? A. No. We used this machine until we got our shapers in.

Q. Let me ask, how long were you in the cam shaft department, Mr. Aptekar? A. I was in the cam shaft department until 1934. I was out for a short period. I was across in Europe for the company.

Q. I show you a photograph, Defendant's Exhibit 53, reproduced in Volume III of the printed record at page 1037, and ask you what that machine is? A. That is the type of shaper used for machining the cams and cam shaft.

Q. If you looked at Defendant's Exhibit 53-B, which is a sketch,—you understand that sketch, the series of drawings? A. Yes, sir.

Q. What does that represent to you? A. Those are the slides for the tool holders that were used on the cam shaper.

Q. That shows the methods by means of which the cam shaft shaper removed the material? A. That is right.

Q. The first view at the left of the page, Fig. 1, shows the— A. —front view of the tool.

Q. The side view of the tool, is it? A. Yes, that is right.

Q. And the two views underneath show the manner in which the tool **(883)** traversed across—that is, the first view underneath shows the traverse of the work under the tool to perform the cutting stroke? A. That is right.

Q. And the other, with the arrow running in the opposite direction, shows what? A. The back stroke.

Q. And the side views to the right, which are numbered 2, 3, 4, 5, and 6, show what,—the manner in which the— A. That shows the manner in which the cam was travelling and the way it was cutting.

Q. The way the shaft rotated relatively to the tool as the tool covered the entire circumference or periphery of the shaft? A. Yes, sir.

Q. Now, let me ask, did you yourself personally ever run any of the shapers? A. Oh, I have at times, just probably a period of 15, 20 minutes.

Q. Under what occasions would you run the shapers? A. Just to try them out and see what they were like, and just get a little experience on them.

Q. Did you ever take any of the machines over and run it while the regular operator was at lunch or anything like that? A. I have on several occasions, yes.

Q. Do you have any present recollection as to what the output was in shafts per hour on the shapers on the machining of the Model T shafts? A. We figured around 30 an hour.

Q. What was the particular duties you had in the department at that **(884)** time, that is, during the machining and manufacture by the Ford Company of the Model T shafts, in the period when they were using the shapers? A. Well, at first I was on inspection there and later on I was put on production there. I was foreman of that section of the job, that is, all their machining, rough machining in the cam shaft department.

Q. How many shapers were they using, do you recall? A. Well, we started out with one shaper, and then we got another one later on, and I believe before we were through we had 13 shapers, if I am not mistaken.

Q. How long did the company continue to use the shapers? A. The shapers were used in Highland Park there. Let's see, that was in 1924, and then we moved to the River Rouge plant there, and from then on we have had some of those Walcott lathes.

Q. Do you have any particular knowledge concerning the efficiency or lack of efficiency of the shapers, from the standpoint of repairs or maintenance costs? I mean did you have very much difficulty with the shapers in keeping them running? A. No, we did not. At first we had a little trouble with our slides there, but we overcame

that by putting guards over that, to keep the chips from going into the slides. After that, those machines run right good.

Q. Were you in the department after the Walcott machines were in use? A. That is right.

Q. What could you say, if anything, concerning the type of work done by the two machines? I mean you were an inspector in the **(885)** department. Let me ask, was it a part of your duties as inspector to observe the contour of the cams and inspect the contour of the cams as they came from both the shapers and the Walcott machines? A. That is right.

Q. It was part of your duties? A. That is right.

Q. Well, now, referring to the two machines as the Ford Company used them on the Model T shafts, what would you say as to the type of work done by the machines from the standpoint of getting the proper contour and finish?

Mr. Spohn: Just a moment. I don't think the witness has stated when he became a foreman. He said he was first an inspector and later foreman.

A. In 1922, I should say that.

The Master: You were no longer an inspector after that?

A. That is right, although it is the duty of every foreman in the Ford plant there to kind of oversee the work that is done, that the quality of work is kept up, and so forth.

The Master: But you were no longer an inspector after that?

A. No, that is right. Now, I can explain this as to the quality of work produced by the shapers. I think they were much better, and we had less scrap out of those machines than we did out of the Walcott machines. For one reason, the construction of the machine was built so that they had actually five places where they held these shafts fast in there, and that in itself caused a better job. On the Walcott machines, where we had the steady rest about 6 inches from the base, hanging in the air there, we **(886)** found an awful lot of spring in those machines there, and this would be a consequence of the machine, the steady

rest going back and forth as the pressure of the tools would cut the stock off the cams.

The Master: What differences did you notice in these results, with respect to the contour of the cams?

A. Well, the contour of the cams was much better on the shapers, because the shaft itself travelled only two revolutions on a complete circuit of the shaft, that is, when it was finished cutting, while on the others the shaft travels quite fast, and at the point of the cam, it kind of jumps over the end of it. It used to dig in with the tool there. That caused a lot of trouble there. We had a lot of minor cams; they did not clean up on the finish end. Also we had to keep them on larger size of the Walcott machine because of that trouble there.

Q. When you say you had to keep them larger size— A. They raised our limits for the rough turn.

Q. You left more stock on for the finish grinding operation? A. Yes, sir.

Q. When you used the Walcott machines than you did with the shaper? A. That is right.

Q. Now, illustrate by reference to an actual shaft just what you mean by this trouble of the tool going around the point? Can you illustrate that? A. I believe I can. I was out to the Highland Park there Monday, and I brought in a shaft that was turned there last Friday, and I can show you the difference, yes. This is where our **(887)** trouble was, right there, the tool digs in there.

The Master: You are pointing to the point of—

A. It is the part in here, this part in here is lower than the actual contour of the cams. These are the parts in here where they did not use to clean up there, where we had trouble with our grinding, and also with polishing the cams. We had to have several men on polishing those cams, and also extra stock in there, grinding them. That is my handwriting. I picked these shafts up in Highland Park Monday.

Q. That shaft was introduced as Exhibit 234. You were referring to what cam, cam number 5, weren't you? A. I guess most of the cams are that way, but this seems to be the worst one there.

Q. That is number 5 cam? A. This is number 6 cam, I believe.

Q. All right. Are you familiar with the operation of the time sheets of the Ford Company that were made by the time study department? A. Yes, sir, I am.

Q. Before referring you, however, to the sheet, I am going to ask you what your recollection was of the various steps or operations performed on the camshaft before the camshafts were sent to the shapers for the shaping operation; and so that your testimony will be more readily understood, I will show you a camshaft which has been introduced in the trial below here, as Exhibit No. 29. First let me ask you, what particular camshaft that is, if you know? A. This is a Model B camshaft.

(888) Q. Now, will you explain to the Court just how —what about preparing that camshaft for the operation on the shaper? A. The first we did there in our department was to center both ends, and then we straightened the shaft, and then we turned this bearing in here, that is, the center bearing, and then we turned them between the cams. We nicked the cams first, we called it the re-set operation, I believe, and then we turned the end bearings, and then we straddled the flange, turned the gear post. Now, you are referring to the shapers?

Q. Yes. A. Then we put them in the shapers and turned the cams on that, shaped the cams.

Q. Was there any differences in the series of operations as performed on the cams prior to going to the shapers, and the series of operations performed on the cams before they were put on the Walcott machines? A. They were all identical with the exception we had the added operation there of straightening. We had to straighten those cams out before they went into the Walcott lathes.

Q. Did you use that operation or any similar operation before you sent the camshaft to the shapers? A. No, we did not straighten those, if that is what you mean.

The Master: You had a straightening operation at one point along the line.

A. Yes, we straightened those right after we centered those as a rough forging. When they are hot, they usually spring more or less. We had to straighten them right after we centered them, just trued up the forging, and here we just used a piece of **(889)** chalk on there to straighten them.

Q. Why did you have to have a straightening operation on the Walcott machine and not on the other? A. I would like to take you over to the exhibit. The way we had our shapers set up there, it helped straighten the shaft somewhat; and on this Walcott lathe we found that we would spring the shaft—we only had a steady rest in here—because it was not very rigid.

Q. You are pointing to the center bearing? A. The center bearing, yes, the steady rest in there.

The Master: In other words, your testimony is that the pressure of the tools in the shaper was—

A. Here is the whole thing. The way it is constructed, you have got this steady rest on the solid base of the machine there, and all the pressure was up against the face of that machine. There was nothing there to give. On the other hand, on the Walcott lathe, we had our steady rest in front here, and that was quite high off the base, if you recall the exhibit in Highland Park. That steady rest wobbled back and forth, as I explained before, and that would cause the cams to be crooked in here, and they would not clean up there. We had to straighten these after they were hardened.

Mr. Farley: Would it help your Honor if the witness explained that with reference to the model that we have here. I might say for the purpose of the record we have in the courtroom two wooden models, which have not yet been introduced in evidence, but which will be introduced as physical exhibits. One of them is marked Model T cam shaper. The (890) witness is going to use that. I will ask that for the purpose of the record this be marked for identification Exhibit No. 237.

Q. Now, let me first ask a few questions concerning this. Now, you testified, Mr. Aptekar, that you were familiar with the operation of these shapers and that you yourself operated them? A. That is right.

Q. Will you look at this wooden model before you and work the handle, and let me ask you first if you understand the model and the working of it? A. Well, the model is very similar to the machine we had in the plant.

Q. And does that model correctly represent the method of operation of the shaper? A. Yes, it does. Of course, we have not got the working parts there, but the model is a duplicate of the machines that we had in Highland Park.

Q. Insofar as the cutting tools are concerned and the relation of the cutting tools to the shaft, it is mounted in the middle, and shows the manner in which the table which carries the shaft functions with respect to the tools, is that correct? A. That is right.

Q. All right, now.

Mr. Farley: I make an offer of the exhibit as illustrative of the shapers used by the Ford Company on the Model T camshafts.

A. Now, here is the working condition of this machine here. We have got a solid base on this machine here. All your tool pressure is right up against the base. There is no give. No **(891)** steady rest whatsoever.

Q. Did you have a solid base of that general type on the machines as used by the company? A. Yes.

Q. Very well. A. You take on the Walcott machines, we had the steady rest right up in here, in the front end of it, which I don't exactly recall, whether it was eight inches or so from the base. All your pressure was from the back, forcing the shaft to the front of the machine there. That would cause our trouble in not holding our camshaft straight on the machine.

Q. Now, have you described why or how the shaper functioned so that you did not have to use the straightening operation on the shapers? A. Well, I do not believe I have. Now, as I said before, start with this solid base in here, your tool is up in top there pressing up against the base there. That would form a solid shaft in there. The other way you had only one steady rest on there, your two collets on the end there. Of course, that shaft being so small in diameter there would force the cams and the stock right out of there. In other words, when we were through with the shaft, maybe we would have .040 more stock on one side of the cam—that would be on center—than we would have on the other; where in this case on the shapers we had a solid base to work to, and the construction of the machine was much more solid all the way through.

Q. When you are referring to the shafts having .040 stock on one side, you were then referring to the operation on the Walcott **(892)** machine? A. That is right.

Q. Perhaps you could—I guess we have not got a shaft here now.

Mr. Farley: Does that answer your question specifically, your Honor?

The Master: Yes. Well, I will admit the exhibit in evidence as supplementing the witness' testimony.

Mr. Spohn: May we reserve an objection to that until cross examination?

The Master: All right.

Q. What did you call—did you have any particular symbol to designate the camshaft department? A. Department 410.

Q. When the Walcott machines were used in the department, as I understand your testimony, you were employed in the capacity of foreman of the department? A. That is right. I was shift foreman at the time.

Q. And part of your duties had to do with the operation of the camshaft machines? A. Yes, sir.

Q. Of the Walcott machines? A. Yes.

Q. What is your recollection, if you have any recollection, concerning the output of shafts per hour on the Model T shafts on the Walcott machines? A. On the Model T we used to run around 30 an hour.

Q. How about the maintenance on the Walcott machines, how did that compare with the maintenance on the shapers? **(893)** A. Well, we had very little difficulty with our shaper machines there, after we eliminated our troubles on the slides as I mentioned before. On the Walcott machines we had a lot of trouble with tools and springs breaking, and also the slides sticking, and I believe we kept about three or four men on each shift maintaining those machines, keeping them in repair.

Q. What is your recollection concerning the number of men you had to keep on a shift in order to keep the shapers in repair, maintenance men? A. We usually maintained a man on each shift there in the department there, and part of the time he worked on those machines.

Q. You were in the camshaft department, Mr. Aptekar, were you not, when production changed over from the Model T to the Model A shafts? A. Yes, I was.

Q. Do you know whether they had any difficulty at the outset of the Model A production, in using the Walcott machines on the Model A shafts? A. What do you mean by the outset?

Q. I mean at the very start of the Model A production, when you first started to use the machines? A. We had to change the form of the cam. We had difficulties in maintaining our sizes on those Walcott machines for the Model A, because they were held—the Model A job was much closer limits than we were held to on the Model T.

Q. Are you familiar with the operation of the Walcott machines? A. Yes, I am.

Q. Will you state whether or not, insofar as the contours of the (894) cams were concerned, the Model A as compared with the Model T, which was, if either—which was the more difficult to machine? A. Well, the Model A was much more difficult to machine, because they had a sharp point or a closer angle, and it was much harder to machine those.

Q. That is, on the Walcott machines? A. On the Walcott machines, yes.

Q. Could you state whether or not that same difficulty insofar as the change in contour of the cams, would affect the operation of the shapers on the Model A cam?

Mr. Spohn: Just a minute. There is no evidence in as yet that the shaper was used to turn out the Model A.

The Master: This is a question of opinion. Of course, he is asking the witness' opinion, assuming that the witness is an expert on this particular problem.

Mr. Spohn: If your Honor please, is the witness here as an expert on that, or just here as a foreman of a department, detailing what he saw and what he viewed.

The Master: So far he has been testifying to facts. He has not been asked for questions of opinion; but the witness, I suppose, can testify to facts and also to questions on which he is qualified to express an opinion.

Mr. Farley: I might state there, if your Honor please, that it is entirely a matter of fact for a skilled man, and the question was limited to the contour of the cams.

(The question was read.)

The Master: I think the question is purely one calling for the opinion of the witness. The testimony is that the **(895)** shaper was never used in the Model A shaft, and the witness cannot testify as a matter of fact as to how well the shaper actually did turn the Model A shafts as a consequence. He can only express his opinion as to the relative merits of the shaper and the Walcott machine, with respect to turning a cam with a sharper point.

Mr. Farley: Suppose, in view of this discussion, and to shorten matters up, I re-frame the question.

Q. Suppose, Mr. Aptekar, or assuming that the Model T camshaft, the contour of the cam of the Model T camshaft had been made the same as the contour of the Model A shaft—do you understand what I mean? A. Yes, sir.

Q. Would that in any way have affected the operation of the shaper in getting the proper shape as it did affect the operation of the Walcott machines? Do you understand my question? A. Yes, I understand it. To my opinion, I don't think it would make any difference, because of the construction of the machine and the tools that we were using on the job, and the form of the cam would not make a bit of difference.

Q. On the shaper? A. Yes.

Q. And it did make a difference on the Walcott? A. Yes, sir.

The Master: Do you know when the straightening operation was actually introduced as an additional operation on turning the cams in the Walcott machine?

A. It was introduced at first there when we had a lot of trouble **(896)** in cleaning up our cams; we were forced to add another operation to it, which was the straightening operation, when we started those Walcott machines.

The Master: Do you know whether there was any discussion of the possibility of providing firmer supports or a stronger steady rest as a means of taking care of that, rather than providing the additional straightening operation?

A. Not that I know of.

Q. What is your recollection, Mr. Aptekar, concerning the production of the Model A camshafts on an hourly output per hour on the Walcott machines? A. Well, we figured around 25 an hour on the Walcott machines per machine, 50 per man; we used to have one man run two machines.

Q. Do you have any way of fixing that as a matter of recollection? Let me ask you this: As foreman of the department there, running those machines, how did you ordinarily do with respect to your operations, that is, you have a certain number of men performing, let us say, the recess between the cams? A. Yes.

Q. And a certain number of men performing the operation of the Walcott machines. Just how did you, as foreman of the department, check this matter of getting out your daily production? Do you go there and make some sort of record for each hour as to what each man is doing, or do you count on a lump sum production per day for each man? A. When we start a new job of any kind, we usually have checkers to check each operation there. In fact, one operator checks the other man, as to how much he produces every hour, and we (897) keep a record of that in the department in each shift.

Q. Now, after you get your department running in regular order and producing the same job for some time, what do you do? Just figure on what you are going to get per man per day, or per shift? A. We have a time study, a time study department in the Ford plant there, and they give us an estimated time on what should be produced on each operation there, and we usually have to keep up to that in order to keep our job there, more than anything else.

The Master: What kind of check do you make to determine whether you are living up to the time schedule?

A. We have checkers every so often there, and they take stock off of one machine, if it is not used on conveyors; if it is on conveyors we just check it at different points. For instance, we will have a section there with four or five operations on it. We know during the eight hours we have to produce so much on that section there. If we don't produce that, naturally the next section will be short

of stock there. In the Model T days, we did not have the conveyor system as much as we have of late here, and in those days we used to have checkers carry the stock from one machine to the other, in order to get their proper amount of production out for each machine.

The Master: What kind of records do these checkers keep?

A. Well, we have boards there every so often, a blackboard, and we mark it up on the blackboard with chalk, as to the amount of production produced in each operation.

The Master: Were there any permanent records kept?

A. Well, I will tell you, each foreman used to have to turn a **(898)** report in to the general foreman on the day shift there, on how much they produced on each operation or each section, in fact. Being this department was quite a large department there, we have a lot of operations on the cam shaft, and we turned those records in daily to the general foreman.

Q. What sort of record is that—a permanent record? A. No, those are destroyed every, probably, couple of days.

Q. I think it would be interesting to the Court to tell a little bit more about this blackboard proposition. Each of the departments has a blackboard about the size of the Master's desk? A. Just about that size.

Q. And at the top of that board, or somewheres on the board, you have a figure given of what the schedule of production is per day, is that right—you have the figure which you are supposed to be shooting at in the department, whether it is 5,000 or 6,000 or something like that? A. I will describe it as a board, if you don't mind. This board is usually put on a stand. We have that in every section, every so often in the department there; and then the hourly production, for instance, like would be 1, 2, 3, 4, 5, up to 8 hours, and then the three shifts all separated, all different sections. Those boards, on them we put the hourly production as they are produced in each section of the department. At the end of the day—we keep those for 24 hours, and after 24 hours we erase that, and leave on the total production produced in the whole department there, on the board there. There is no record, as far as we are

concerned, but there is a record noted in the superintendent's office; we turn in a record every **(899)** day on each shift how much we produce.

The Master: How many operations constitute a section of the department?

A. That all depends. In this cam shaft department particularly we would have, I would say, five sections.

The Master: What would be the operations included in the second section, including the rough turning operation?

A. This includes in one section there all up to the heat treat department, in those days of the Model T and Model A cam shaft.

Q. The real purpose of the board there, you foremen, I assume, keep a pretty close watch on the board, and let us say you had a schedule of production of, well, to make it easy to talk about, we will say four thousand a day? A. That is right.

Q. That would mean that, in order to meet that production, you got to have your department turning out a certain number of shafts every hour? A. Yes, sir.

Q. Suppose if your department starts to fall down, then your main shop foreman would probably get after you as the shift foreman on that particular section, and get you to pep things up, is that the way it runs? A. The general foreman usually comes in and finds out where your weak points are, when he sees the board is not up to date. In other words, if you don't produce 500 an hour, as you must do to get 4,000 a day. If you don't produce that 500 an hour, then he wants to know where your troubles are. He probably would come in and if we need any help in there, we would get it. **(900)** If there is any trouble, we two get together on it and straighten matters up.

Q. By the way, do you know a man by the name of Ralph Myers? A. I do. He was my general foreman at the time I worked in the cam shaft department.

Q. If your section was not keeping hitting on the ball, we will say, why, Ralph Myers would probably be the one who would come after you, get after you? A. That is right.

Q. Concerning this straightening operation you are talking about, did you have to use this straightening operation on the Model A shaft when you turned them on the Walcott machines? A. Yes, we did.

Q. Suppose you would use the shapers for turning the Model A shafts would the straightening operation, in your opinion, have been necessary?

Mr. Spohn: If your Honor please, that is pretty hypothetical, in view of the present state of the record.

Mr. Farley: It is a matter of opinion here. The witness has testified and given reasons for the straightening operation.

The Master: I will let him answer the question.

A. Why, it would not be necessary to straighten those.

* * * * *

(910) Q. As I understand your testimony, you were working in the capacity of **(911)** foreman when you were over at the Highland Park plant, and you also had the same duties as foreman when you were over there—or was it of inspector? A. No, I was foreman after two years, before I came to the Rouge plant.

Q. Can you state whether or not the company provided the foremen of the Highland Park with any particular stationery or other material for the purpose of keeping records for their own information? A. Yes, they have. Every foreman in the Highland Park plant was furnished with a little book there about this big, it had a brown cover on it, in which we usually kept our records of our production and our time required for each operation, as a rule. I had one of those books myself. I believe I destroyed it some years ago, which it was not necessary for me to use any more.

Q. Do you know a man by the name of Spencer Libby? A. Yes, I do.

Q. I am going to show you a book and ask you if that is in— A. This is the type of book that we were all furnished in Highland Park.

The Master: That is Exhibit No.—?

Mr. Farley: Counsel has just shown the witness Exhibit L.

Q. I will ask you to refer to pages L-1, that are marked L-1 in that book, and state what the information contained on those pages means to you, if anything? A. Well, this looks like a time study copy of some kind there, on the cam shaft job.

Q. Let me ask you this, Mr. Aptekar, did you ever see that particular **(912)** book before? A. No, I did not.

Q. Do you recognize any of the operations listed here as having—state whether or not you recognize them, or what you do recognize about that? A. Well, this is a duplicate of our operation sheets that were on the Model T camshaft.

Q. How do you know that? A. Well, I can tell by the operation layout in here.

Q. How do you know it was the Model T cam shaft? A. I believe that is the time that—

Q. Is there anything in any of those operations that enables you to identify that as a Model T time study? I will ask you to refer to operation 12 there. A. Shape cams, operation 12.

Q. Was an operation of shape cams ever used in the Model A? A. No, we did not use it in the Model A.

Q. Does that in any way help you to identify that? A. That is right. I did not notice this operation 12 on here, which calls for shape cams, which we did not use on the Model A.

The Master: Did you ever keep time study records in a note book that was furnished to you?

A. Yes, I did.

The Master: Do you know whether it was common practice for all shop foremen to do that?

A. Most of them did, yes, for our own use there, because we were required to produce a certain amount of shafts on each operation. **(913)** If you did not know just what you had to produce there, it was kind of hard,—they would come in and ask you occasionally just what you had to do on a certain operation, and we had to be pretty well lined up on that. In fact, I had one of these books myself some time ago, and I burned it up since I had no use for it. I have been out of the cam shaft job now four years, in fact, this is the fifth year, and since I had no use for it I burned it up.

Q. As a matter of fact, later on, did not the company over at the River Rouge plant discontinue this system and take all these books away from the foremen? A. Yes. We have a fellow by the name of Mr. Harvey in the Rouge plant there, and he objected to all the foremen carrying their books around, in fact, a lot of other records were destroyed; we were not supposed to have any records around the desk there, any papers or anything; they were all destroyed; done away with all records.

* * * * *

(914) Cross Examination by Mr. Michael.

Q. Mr. Aptekar, are there any of these shapers in existence now? A. Not that I know of, no.

Q. I think on your direct examination you referred to this Exhibit 29 in describing the operations prior to the turning or shaving. What was the first operation on the shaft? A. We turned the center bearing.

Q. Is that the first operation? A. No, pardon me. The first operation was to center, center both ends.

Q. Then what? A. Then we straightened those with chalk.

Q. How was that straightening done? A. That was put in between centers, and we used to hold a piece of chalk up against there between the cams, just to rough straighten that as a forging.

Q. Then you pulled a press or something down? A. We had a hand press, a Springfield 00 hand press.

Q. Is that the same straightening operation done today? A. We are not using this type of cam shaft today.

Q. Well, was it done when you were? A. On the first operation at all times on forgings. Now, we are using a cast alloy cam shaft, which does not require any straightening.

Q. But getting back to these earlier operations, you used that straightening operation on the form miller and on the shaper and on the Walcott machines? **(915)** A. That is right.

Q. And then your next operation was to turn the center bearing? A. Turn the center bearing, yes.

Q. Then what happened? Was the shaft still straight then? A. Yes.

Q. Then what did you do? A. Then we nicked—recess, what we called it—we would nick that between the cams there, to mark for the spacing of the cam.

Q. Did that make the cams crooked? A. It did not.

Q. What was the next operation? A. The next operation, we turned the end bearing.

Q. Did that make it crooked? A. Pardon me. We turned in between the cams after the recess, and then we turned the end bearings, and then we turned the flange, and the gear post.

Q. Did any of those operations make the shaft crooked? A. No, they did not.

Q. What was the next step? A. The next operation, we put it in the shaper.

Q. Then the shaft was straight when it went in the shaper? A. It was, yes, it was straight enough that the cams would clean up on the shaper. On account of the construction of the machine, that held that shaft solid in there, and it was straight enough to do our operation in of shaping the cams.

Q. Did you do the same operation that you just described when you used the Walcott machines? **(916)** A. All operations, with the exception of the added one, we added another operation of straightening.

Q. Wasn't the shaft straight when it got to the Walcott machines without straightening? A. It was straight enough, provided you could hold the shaft in there solid enough so you could turn the cam; but holding it on each shaft and just one steady rest on the center there, the shaft would spring in the operation.

Q. Even though it was straight when you put it in there? A. Yes.

Q. How would straightening keep the shaft straight in the machine, if it was straight without straightening? A. Here is what happened. If this shaft here was actually sprung in the Walcott machine, and they had to be very straight there, in order to get them in there—

Q. Are you drawing a distinction between straight and very straight? A. Well, there is such a thing, yes. You can bend the shaft here to a certain extent so that it won't work in a machine.

Q. What bends it? A. The various operations would bend the shaft in the previous operation.

Q. I thought we just went through these operations step by step? A. Yes.

Q. With the shaper, and you said the shaft was straight when it went into the shaper? A. I would not say it was exactly straight. It would be bent somewhat, but not enough to do any damage in the following operations.

Q. When it went into the Walcott machine, it was just as straight **(917)** as when it went into—it would have been just as straight going into the Walcott machine without the straightening operation as it was going into the shaper without the straightening operation? A. That is right. But, now, suppose this shaft was running, say, 15 thousandths of an inch; this shaft was not supported in between these points in here; then in turning this here at high speed, there, that would offset the cam, with this other part there, where we would not do this on the shapers. We would hold the shaft in this part in here, and that automatically straightened the shaft right there.

Q. If the shaft was crooked when it went into the shaper, would it be crooked when it came out of the shaper? A. No, it would be somewhat straighter.

Q. What do you mean by somewhat straighter? A. Because of holding this shaft in between the cams.

Q. Would that shaping operation actually straighten the shaft, the body of the shaft? A. It would help it some, yes.

Q. All it could do would be to spring it? A. That is what happens to any crooked shaft, that springs; that is what happened in the shaper.

Q. If it is crooked when it goes into the shaper, the shaper springs it straight? A. It does in a way, yes, and it also turns it concentric with the cams wherever you hold it.

Q. Do you want to change your testimony, then, that the shaft, when it went into the shaper, was a bit crooked, or was it straight? **(918)** A. Well, it was somewhat crooked, I would say yes.

Q. And when it went into the Melling machine, if it was not straightened, it would be crooked, to some extent? A. It would be more crooked.

Q. When it went into the machine? A. No, it would be about the same shape, naturally, because the operation

was identically the same, but we would have to straighten it a little more closely because you had no support—you had no way of holding the shaft in the proper position there, to hold it concentric with the cams there. This was up in the air between this point in here and the collets on the end there. This shaft was all—

The Master: You mean between the center bearing and the collets on the end?

A. Yes, the center bearing and the end bearing and the collets. I was referring to the gear post end.

Q. If the Walcott machine did not hold the shaft steady enough without the straightening operation, why did not you put on two supports intermediate to the center bearing? A. That was out of my jurisdiction. I did not have anything to do with that.

Q. In your opinion, would that have corrected the matter? A. We never tried it. I don't know.

Q. You are sure the shapers had five supports? A. Yes.

Q. Is this a photograph of the shaper at page 1037 of the record? A. Yes, it is.

Q. That machine is shown there as being operated—
(919) A. Yes.

Q. —by an operator, and the work in place? A. Yes.

Q. How many supports do you see for the shaft? A. I see three supports in that one.

Q. Is that contrary to your understanding of the machine? A. Well, I don't know why they have not got those—the machines were not designed, and we had those five supports in there.

Q. There were drawings of the shaper introduced in evidence down below as Exhibit 63. Do you recognize this drawing as being a drawing of the shaper? A. Yes, it is similar to the shaper we used out there.

Q. How many supports do you see in that? A. I only see three supports on that one.

Q. Just one center bearing? A. That is right. Is this a photostatic copy of our shaper there, of our blueprints there?

Q. Yes. Mr. Farley has the prints that were actually introduced. These are photostatic copies of the prints, Exhibit 63.

The Master: With these additional supports that are not shown on these drawings, this photograph that was just shown to you, did you grind or smooth the bearing immediately above the supports so that the work piece would rest smoothly on the supports?

A. Yes, they were ground.

Q. Which parts were ground? A. I did not quite get that, your Honor.

The Master: Well, I was asking—

(920) A. If this was ground here?

The Master: You ground the center bearing, did you not?

A. No, we did not grind it. Just rough turned it.

The Master: Just turned it?

A. Just turned it, yes.

The Master: Did you have the same sort of operation immediately above the other two supports?

A. No, it was the same operation. We turned this and we turned the bearing. That was supported here and supported there. Of course, we did not have this eccentric on the cam on the Model A or the Model T shaft.

Q. I show you pencil sketch that I mark for identification as Exhibit QQ, in which I have attempted to show, very roughly, the side elevation of a cam shaft, the wedge shape marks at the end of it being the centers on which it is supported, and this wedge shape mark in the center being the steady rest? A. Is this the shaper?

Q. This is the shaper. A. We did not use centers in the shaper. There were collets there.

Q. Well, we will let that represent collets then. A. That makes a lot of difference there. You are holding that so much closer, making this a collet in here. The collet held just about this far here. This gear post end there, that was held right on the gear post there. And I should put a flange in there, shouldn't I? And the collets come right up to here, like that.

Q. Will you mark those two things, "collets," these V-shaped figures that are just above the cam shaft are supposed to represent (921) tools. I will mark two of them

with the letter T. Now, let us assume when you had this shaft in the machine, when you put this shaft into the machine, it is crooked, either between the one end bearing and the center bearing, or between the end bearings, in other words, if it is crooked from end bearing to end bearing, the center bearing would be out of line? A. That is right.

Q. And you start your shaping operation; now, the shaft in the latter event would be bowed upwardly, we will say, when it is put into the collets? A. Yes. That is exaggerating it a lot.

Q. Well, it might happen, might it not? A. Well, I don't see why it would bend that much to cut a bow in it.

Q. If it is bent at all, it would have a bow in it somewhere? A. We are talking in thousandths of an inch.

Q. Well, it would be a thousandth of an inch bow? A. That is right.

Q. It never bowed any more than that? A. Oh, yes.

Q. Well, what would be the maximum bow? A. I could not tell you offhand just what it would be.

Q. Would it be as much as 20 thousandths? A. In some occasions I would say yes.

Q. Would that be common or very uncommon? A. I would say it would be quite common to have them run out ten to 15 thousandths.

Q. Would it ever vary as much as 50 thousandths? **(922)** A. Not that I know of.

Q. 30 thousandths? A. Sometimes it would, yes.

Q. Well, in that event, or in any event, the variation of crookedness from one end bearing to another, the bow would be sufficient—or tell me first, what would you do with the center bearing,—was that adjustable in any way? A. No, there was a solid rest there, you could not adjust that.

Q. So if the shaft was bowed from end to end, there would be a time when the center bearing would not even rest on center? A. That is right.

Q. If the tools now in operation were fed from—well, I don't think the tools moved, did they—they did not traverse the work—the work moved on the tools? A. The tools were solid; just travelled up and down with the form of the cam.

Q. The tools, the work, then, in the position of the tools here, would be in a position to take the first cut, is that right? A. Yes.

Q. Or, take a cut, and in taking a cut, the work would be moved to the left under the tools? A. Yes.

Q. When this bow or when the crookedness of the shaft or the bow in the shaft was in the uppermost position, that is, the shaft was bowed upwards this 10, 20 or 30 thousandths, and came back in this position, to take a cut, the tools in engaging the work, would what—force the shaft down against the support? A. Under pressure on all tools coming down, at the same time this **(923)** shaft would straighten up, resting on the lower steady rest of the machine.

Q. Now, how quickly would it straighten up? A. As soon as the pressure would force the shaft down with the tools.

Q. When would that be? A. The shaft is moving to the left against the—

Q. —the tools, is it not? A. Yes.

Q. It would not force it down the instant it hit the tools? A. Naturally, as soon as the tools would hit the shaft on top there, it would force it down.

Q. Would it force it down the instant the tools hit the edge of the cam? A. I believe it would.

Q. Do you know? A. Well, it is so far back I do not really recall, but my experience tells me that as soon as your tools will strike this shaft there, it would force that shaft down, being such a length there and the diameter being small, three-quarters of an inch, that would force the shaft right down against the steady rest of the shaper.

The Master: You cannot tell by actual experience; the bow is so small you cannot detect it with your eye, so you are simply inferring that maybe what would happen, the result?

A. The result is that the tools would force the shaft down, regardless of whatever springing you would have in the shaft, whether it would be 30 thousandths or one thousandth. Your **(924)** cam shaft would always rest on the steady rest firm as soon as your tools would touch the shaft. There is a long span in between those two collets there. If this thing was up in the air and your tools come down here, they will force on there. We were taking quite a bit of stock off of there, I believe it was a sixteenth of an inch, if I am not mistaken, from the rough forging to the size of the

cam. Your pressure on all tools hitting that at the same time, that would force it right down and actually keep it firm and straight while in operation.

Q. But it could not force—the tools could not force the shaft down except while they were cutting? A. As soon as the tools strike the shaft, it would force it down.

Q. They were cutting as soon as they struck? A. You can bend the shaft down like this with your hand pressure, and probably bend it four or five thousandths.

Q. Would not there be any irregularity in the first cutting action of those tools on the cams where the shaft is receding? A. I don't think so.

The Master: Until the tools got on top of the particular cam being cut, it would not force it down, you would first have to get the tools on the cam?

A. That is right, but as soon as the pressure of the tools would strike the shaft, that would force it right down there, because you have an even amount and all tools come down at the same time.

The Master: Wouldn't it make a little nick on it until the tools actually got on top of the cam?

A. It might make an impression there, but it would not be much of (925) a nick in there. That would apply to any cutting tool. You can find this same thing in here, where the lathe is taking a cut in there, but after it gets to the top in there, it presses it right down against the steady rest there.

Q. If you had only three supports for the shaft, as I have shown in this sketch, Exhibit QQ, the tools coming down on these cams intermediate to the bearings, would cause some depression in the shaft, would they not, causing some receding of the shaft or springing of it down? A. As soon as the tools would touch the cam shaft, yes.

Mr. Michael: I will offer this sketch in evidence as Exhibit QQ.

Mr. Farley: No objection.

The Master: It is admitted.

Q. Mr. Aptekar, I understood you to say on direct that these shapers took two cuts? A. I did not say that.

Q. Well, I understood you to say that. They took only one cut? A. I did not say that.

Q. Well, what did you say? A. Nobody asked me that question.

Q. What is your answer to that? A. There is two cuts—the machine was designed to make two revolutions, but there was only one cut there.

Q. What did you use the second revolution for? A. The machine was set so as to make two revolutions to complete the cycle, but there was actually one cut on there.

Q. I wish you would explain that for me. In one revolution the **(926)** tools would traverse the entire surface of the cams, wouldn't they, but the entire surface of the cam? A. Well, they would, but they would not finish it.

Q. Then what did you do,—go around and take another cut without adjusting the tools? A. No. Put it the other way now. This work here made two revolutions to complete the cycle. Now, on the Walcott machines, I don't know how many revolutions it made, but it ran around 220 r.p.m., I believe.

Q. Let us just stick to the shaper a minute. Describe to me what you mean by a cycle? A. The cycle means from the time—supposing this cam was upwards when it started cutting; then it made one complete revolution and continued on around there until it came the second time around. This means one cycle of the machine, which made two revolutions in the cutting of the cams.

Q. What happened to the first revolution of the work? A. It would cut the cam naturally.

Q. And what would happen during the second revolution? A. It continued cutting it around there.

Q. Well, it did it then in two cuts? A. No, it is actually one cut there.

The Master: Assume you had one complete revolution of the cam shaft up now, what would be the state of the cam?

A. The cams would be oversize, they would not be completed yet.

The Master: They would be cut smoothly all the way around, they would not have gaps or spaces which had not been cut?

A. No. You can stop your shaper at any angle at all or any time. **(927)** Suppose we make just one quarter of a

turn, it would cut all these cams up on top here. Then if you continue your cycle around there for two revolutions, that would complete the job, and make it down to size.

Q. Did you say you took off about a sixteenth of an inch? A. I don't know exactly what our forgings were of late there.

Q. I am speaking now of the shaper. I understood you to say you took off a sixteenth of an inch? A. I believe about a sixteenth of an inch.

Q. Then on the first revolution of the shaft with the machine operating, you would take off a sixteenth of an inch of metal all around off each cam? A. I would not say quite a sixteenth of an inch, on account of a certain amount of back pressure on your tools and one thing and another; it took some more stock off the second turn, which completed the cycle.

The Master: Was there any re-setting of the tools for the second turn?

A. No, there was not any. We just—we would just bring the head right down and leave it there until it made the complete cycle there, and then they would shut it off automatically with a switch, an automatic switch on it.

Q. The first cut was a heavy cut, there would be no adjustment of the tool, all you did on the second cut was to clean up? A. Evidently did, but I would not call this as a second cut. It is the second revolution of the shaft.

Q. But the tools were working, and were they removing metal? A. Yes, they did, yes.

(928) Q. Evenly all around or just in high spots? A. No, evenly all around.

Q. What was the pressure of the tools on the work on that second cut compared with the first? A. There would be naturally less pressure on the second cut than the first.

Q. Tremendously less? A. I don't know just how much.

Q. Would it be greatly less? A. There is no way of checking it. My imagination is there would be less pressure on the second revolution.

Q. There is a way of checking it? A. Yes.

Q. It is a sixteenth of an inch against maybe a few thousandths? A. Yes, that is what I say.

Q. Then if the shaft was crooked when it went into the shaper— A. It automatically will straighten there; all this pressure of taking this stock off there, and pressing up against the solid bed of the machine like this here, it would automatically straighten the shaft some. On the second cut it would naturally clean up and make a smooth job all the way around.

Q. Is it your position that a crooked shaft going into the shaper would come out straight? A. It would, to some extent, it would straighten itself in the shaper.

The Master: When you straighten the shaft in a press, you press it in the other direction, you get a bow opposite to the one you have in the crooked shaft, and then it springs back to **(929)** normal?

A. Yes.

The Master: You would not get that effect with your cam shaft shaper, because the most your pressure would do would be to hold the cam shaft absolutely straight while it was being cut?

A. Yes.

The Master: And then the tendency would be for it to spring back to the bow shape again?

A. It would naturally do that, yes. It was straight while it was cutting. That is the object of the steady rest and the construction of that machine there.

The Master: It would be just about as crooked when you pulled it out as when you put it in?

A. Yes, but you see between the cams—

The Master: You mean while it was shaping, it was straight, because of the pressure of the tools on the cams, but when you pulled it out—

A. It was just as crooked. We did not care anything about that, because they went into the fire after that operation, and they would spring anyways in there, 1800 degrees heat there; they would spring anyways.

Q. Under this first cut, the shaft would spring quite a bit? A. It would straighten itself. It would not spring. It would spring back to the natural shape, because of the steady rest on the bottom, on the solid base.

Q. All right, then, on the second cut, when it had sprung back to natural shape, you would take a lot of metal off one side of the **(930)** cam and none off another, and so on around? A. Not necessarily, no.

Q. How could you avoid it? A. Because you had pressure under your second revolution of your shaft anyway.

Q. You had what? A. You had a certain amount of pressure on there anyway.

Q. Yes, very light pressure. Can you tell me how much pressure? A. I never measured it.

Q. But you could judge pretty accurately? A. I have not measured it there, but through my experience I find that the second cut on those shapers were quite a bit of pressure, although there was not as much as on the first revolution on there, on the shaft.

Q. In the Walcott machines, the steady rest at the center of the machine rested on the bed of the machine? A. Yes, but it was not right direct on the bed of the machine.

Q. It was not on the bed of the machine? A. It was held down by a bolt in the center, and the steady rest was up about, I don't recall whether it was five or six inches off the bed of the machine, and the pressure—your tools were in the back of the machine, instead of being on top, and of course, that naturally had to sway in the steady rest, because all that was holding it was holding on the base of that machine there.

Q. But your steady rest was directly opposed to the tool pressure? A. Yes.

The Master: Is your tool pressure constant or always **(931)** changing?

A. It was just opposite of what your tools are cutting. The only thing we did not have sufficient pressure on that steady rest there, because we did not press down on it, we pressed sideways, and that caused a certain amount of give in the steady rest there, which caused the shaft to be crooked while it was turned.

The Master: Your tools are constantly changing their position in the Walcott machine?

A. But the pressure remains the same.

The Master: In the same direction?

A. Yes, they do. They do not go around the shaft. The tools are stationary. They go up and down some, but they still remain—the pressure is on the same side.

Mr. Farley: May we refer to this model?

A. You see, your tool pressure would be always—it may go up and down a little ways, but your pressure, your shaft will spring out this way, regardless of what position your tools are in.

Mr. Farley: I am referring now to Defendant's Exhibit 140, physical model Walcott machine, which was used at the trial before Judge Tuttle.

The Master: The pressure will always be in the same general direction, but there will be some alterations in it as the tool changes positions.

A. Some, but not very much. You will have to turn it faster than that, Mr. Farley.

Mr. Farley: (Demonstrating.) I cannot turn this 220 r.p.m.

(932) Mr. Michael: Your Honor, that is all I have at the present, but I would like to reserve the right to recall the witness for further cross examination a little later, if I find it necessary. There are certain things we would like to check in the record.

Mr. Farley: What is that?

The Master: He says he wants to recall the witness at a later time.

Mr. Farley: That is all right. Did you want to say something?

The Witness: This photostatic copy that was presented to me by this gentleman here,—I don't know your name.

Mr. Michael: Michael.

The Witness: You showed me a print of the shaper showing only three steady rests on there, and also a photograph. Now, I don't know what date this print was made, but we showed three steady rests in there besides the collets.

The Master: Do you have a very definite recollection on that point, that there were five places at which the shaft was resting?

A. Yes. In one particular occasion I remember we had all machines equipped with five supports there, three steady rests and two collets.

The Master: What time did you say you went into the cam shaft department?

A. In 1915.

The Master: At that time they were using the milling machine. Do you recall the period there when they were using **(933)** machines with only one steady rest?

A. No, I don't recall that. They might have taken those steady rests off for, probably, easier operation in handling, but as I recall it we had three steady rests.

The Master: Your recollection is quite positive on that point?

A. Yes, I know we had three steady rests on there. It is possible they have removed those for particular reasons of handling, because, as I remember right, there was little difficulties in getting the shaft in and out of the machine there, due to the cams striking those steady rests. It is possible they may have moved them out later on. I don't quite recall that. I was under the impression we had three steady rests on those machines. In fact, Mr. Farley's blueprints show that, too.

Mr. Michael: Well, what is that blueprint?

Mr. Farley: One I intended to introduce later, this particular one he is referring to is—

Mr. Michael: It is not an exhibit in the case?

Mr. Farley: It is not an exhibit in the case. It has the date of 11-17-13. I will prove this up by a later witness. I will have this marked for identification at this time. There are just some notations of names that I scribbled on there while I was using the telephone. This will be Exhibit 242.

Mr. Michael: What was the date on there, Mr. Farley, 11-17-13?

The Master: Any further questions?

Mr. Michael: Not at this time.

(934) RE-DIRECT EXAMINATION by Mr. Farley.

Q. Only one point. You were questioned at some length by Mr. Michael concerning one or two cuts on the shaper. I think you draw a distinction between a machine in which there is a definite mechanism for moving the tools in for a second cut as in the Walcott machine, and the case of your shapers where you just let the tools—the shaft run around a second time, without changing the position of the tools? A. There was no fitting attachment of any kind or change of tool sizes as far as that is concerned.

Q. That is what you had in mind when you said the shaper did not take two cuts? A. That is right.

Q. That is all.

WILLIAM D. HUNT was called as a witness, and being first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. Where do you live, Mr. Hunt? A. Jackson, Michigan.

Q. Were you at any time ever connected with the Walcott Machine Company or the Walcott Lathe Company or whatever the name was? A. Yes, sir.

Q. And when were you connected with them? A. I think I went to work there in 1922.

Q. In what capacity were you employed by the Walcott? **(935)** A. In the engineering department.

Q. Are you familiar with a certain type of machine that was known as the Melling cam turning lathe? A. Yes, sir.

Q. Did you, in your work in the Walcott Machine Company, have anything to do with that particular machine? A. Yes, I was in charge of the designing of that machine.

Q. Did you have anything at all to do with the designing of certain Melling cam turning lathes that were sold by the Walcott Company to the Ford Motor Company? A. Yes, sir.

Q. Do you know when those machines were sold by Walcott to Ford? A. I think I can get the date right off the blueprints. That would probably be better.

Q. Well, what did you have to do with those particular machines? A. My position was to lay out what we call the

set-up on each different machine as it was sold to the different companies, the set-up had to be made for that particular shaft, to fit that machine.

Q. That means that each time you sold a machine you had to make changes in the detail construction of the machine to fit the particular shaft for which it was designed or which it was going to turn? A. Such as the collets and your steady rests, and, of course, about 80 percent of the machine was standard.

Q. Now, will you state whether or not that is the ordinary practice of engineering and machine tool designing, to make the necessary changes that might be required in a machine, in view of the **(936)** machine turning different products or different shafts? A. It is absolutely necessary in order to turn the different shafts.

Q. Is that regular practice, regular everyday work? A. Yes, it is regular practice.

Q. Now, were you familiar with any other machines sold by the Walcott Company, to companies other than the Ford Motor Company, of these Melling cam turning lathes? A. Yes, sir.

Q. What was the difference, if any, between the machines sold to the Ford Company and those sold to other companies? A. Well, the first machine, I believe, that we sold to the Ford Company, there was no difference, so far as the general—that was the tractor job, I think that was the first machine; we had standard gears on it. Then, when we sold them to Ford's, they wanted to see, if possible, to speed the machines up, and we put a faster feed gear on the machine.

Q. Speed gear or feed gear? A. Feed gear. As far as the speed is concerned, that was governed largely by the sprockets from the motor to the clutch, and with all different machines we have quite a variety of sprockets.

* * * * *

(949) Q. There has been some testimony here, Mr. Hunt, generally to the effect that as those machines—well, let us take it step by step, that, let us say, after six months after the machines were in the Ford Company, and during which time our records show that they produced approximately a million shafts, that they would not then be operating efficiently after the six months period of use, it being

suggested that perhaps the company had not learned how to use the machines by that time. What would you have to say about that?

Mr. Spohn: If you know.

Q. If you have any opinion on the matter.

Mr. Spohn: Just a minute. Will you read that question?

(The question was read.)

Mr. Spohn: Objected to as calling for an opinion, no (950) proper foundation. What does he know what efficiency the Ford Motor Company had on those machines.

Mr. Farley: Might I ask what your own witness, Mr. Moise, meant, when he expressed this opinion. I think the designer of the machine, the opinion of the designer of the machine is worthy of considerable weight in the case.

The Master: Did you have any experience as to the length of time it generally takes operators of machines or companies using these machines, to get the maximum efficiency of production out of them?

A. With the cam machine, it should not take so very long, because there are only a few operations that the operator has to go through. In probably a week or 10 days he would become very familiar with the operation of that machine.

The Master: With a machine of this sort, which was designed at least for a particular shaft, for the first time, in 1924, when you sold the machines to the Ford Motor Company, would there be a certain length of time in which difficulties would be arising in the machine, to a much greater extent than after the machine had been in use for some time.

A. I think the first machine was the tractor machine, and after that had been in the Ford factory for some time, we changed the design of the spindles, the spindle gears, to make it a more efficient machine, and one that would not wear so fast and give longer life, and after that, those spindles would hold up.

Q. This change of design you are referring to, Mr. Hunt, was that merely change of design or change of materials with the substitution of harder steels or what? **(951)** A. No, it was really a change in design. You see, in the first place, your tail stock spindle has to be moved back and forth, in order to remove the cam shaft from the machine. At first that spindle moved back and forth and also revolved in the bushing. Dirt or anything could get on the shaft as the shaft was in the forward position, and then be drawn back into the bearing as it revolved, and would wear this bearing more rapidly than if you had only one motion, the forward and back motion of the spindle.

Q. That means, then, as I understand it, that in the first machine which you sold to Ford for the Model F, or the tractor cam shaft, you had a drive on the tail stock as well as the head stock? A. That was a drive on both ends in both cases, but the spindle moved back and forth in the bushing, and also revolved in the bushing on the tractor, and this design was changed so that the spindle moved back and forth in a sleeve, and then the sleeve revolved in the bushing, and the spindle did not revolve in the sleeve.

Q. So that, if any chip should happen to fall on that tail stock spindle in the later design, they would not be carried on in between two parts that were rotating? A. Exactly. That made a better designed machine.

Q. When you designed the Model T machines, however, that change was incorporated in them, as I understand it? A. Yes.

Q. Now, assuming you have your machines, and let us refer specifically to these Model T Ford machines and assuming that a stop **(952)** watch time study, taken in the latter part of 1924, we will say was made of the machines, which indicated a definite production or a more or less definite production, would there be anything, in your opinion, that would alter the conditions in 1925 or 1926, assuming that no change was made in the machine? What factor, if any, would change that situation? A. As far as the actual time of one single operation was concerned, they would be the same, as you have not changed your gearing or the speed of your motors, and of course, the time cycle then would be the same at that time as any other.

Q. So that any changes that would occur would be changes in and part of the production cycle, which is other

than the actual machine time? A. Yes. In other words, if the parts were worn and the machine had to be tuned more on account of worn parts and changes made, there would be your loss in time and not in the actual cycle of the machine.

Q. Of course, any other variations there might be, then, would be variations in the system of handling the work? A. Yes.

Q. Of course, that could affect the cycle? A. Yes.

Q. But insofar as the machining time was concerned, that would remain fixed throughout the entire period of use of the machine? A. Yes.

Q. Except for loss of time due to breakage of the machine or the necessity of greater maintenance, is that right? A. Yes.

(953) Q. Now, I would just like you to state, Mr. Hunt, with your experience with these machines, would you say that as far as maintenance is concerned, that the maintenance costs would be increasing or decreasing throughout the period of use of the life of the machines? Do you understand my question? A. Of course, as you know, the heads of this machine was rather narrow, and it is impossible to build heavy bearings in the tool heads themselves, and therefore, after a certain number of revolutions, those bearings are worn and have to be replaced.

Q. The wearing of those bearings, however, will you state whether or not that would affect the time cycle? A. That would not affect the time cycle.

Q. Are you sufficiently informed concerning the operation of these machines at the Ford Company, to know whether or not your figure of 85 percent actual operation was actually achieved by the machines? A. I am not.

Q. I did not expect to go into this particular matter with you, Mr. Hunt, but you were present during the testimony of the former witness, Mr. Aptekar, and he was questioned at great length concerning the spring of the shaft, and its functioning in the cam shaft shapers of the Ford Company, a great deal of his examination being, I would say, directed, perhaps, to matters of opinion on his part. Let me ask you, did you ever see these Ford Company's cam shaft shapers? A. No, sir, not in operation.

Q. Did you understand the testimony of Mr. Aptekar's sufficiently to understand how that machine would function

in performing **(954)** those cutting strokes? A. I believe I did.

Q. Did you hear his testimony concerning the shaper tools bending the shaft down as they—assuming that the shafts were pulled upwardly and supported at the two ends as he described—that the tools would bend the shaft down and hold it in a straight position? Would you say that was in accordance with what would be expected in the operation of that machine, considering it from your knowledge of the machine and as an engineer? A. Well, naturally, when the shaper tool hits a piece, it causes a pressure, and if there is not something to resist that pressure, the shaft is going to bend, and the pressure being more than the power of the shaft to resist that, I would say that the shaft would give to a certain extent, probably sufficiently to bring it down directly into the bearings that were lined up for it.

Q. All right. You may cross examine.

(Thereupon, a recess was taken until 2 o'clock p. m.)

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(955) Detroit, Michigan,
Thursday, January 26, 1939,
2 o'clock p. m.

Hearing resumed pursuant to adjournment.

The Master: You may proceed, gentlemen.

W. D. Hunt thereupon resumed the stand as a witness on behalf of the Defendant herein, and having been previously duly sworn, testified further as follows:

Cross Examination by Mr. Spohn.

Q. Mr. Hunt, you testified that you were employed by the Walcott Machine Company along in 1921 and 1922? A. Yes. I think I started to work there in 1922.

Q. And, how long did you work there, then? A. I am still with that same organization.

Q. Still with the Walcott? A. It is the Crank Shaft Machine, they are still building. It is a different company, but I was transferred from the Walcott Machine over to the Crank Shaft Machine Company.

Q. And, what machines do they manufacture? Just crank shaft machines? A. Crank shaft machines, and they build the cam shaft machine for the Walcott Machine Company.

Q. Are they still making some of those machines? A. Yes, sir.

Q. Are they still making replacement parts for them? **(956)** A. Yes, sir.

Q. Now, the Walcott machine was pretty generally accepted by the automotive industry, was it, along about 1921 to 1930? A. Not 1921. I think the Walcott cam shaft machine, when I first went there—of course, the cam shaft machine was rather new. I don't know just how long it had been going at the time when I went to work. I don't know when the first machine was made.

Q. But, a good many of the automobile companies purchased and used the Melling machine? A. Yes, sir.

Q. And, do you know whether any of those companies are still using that machine for turning cam lathes? A. They are.

Q. For turning cam shafts? A. For turning cam shafts.

Q. They are? A. Yes, sir.

Q. And you still make replacement parts for them? A. Yes, sir.

Q. Do you know the extent to which the Melling machines are still being used today by any of the automobile companies? A. I couldn't tell you just how many they are using. The Dodge, I believe, are using it; Chevrolet are using them; Packard.

Q. Cadillac? A. I believe they are; yes, sir.

Q. Nash? A. Yes, I believe the Nash are using them.

Q. White? **(957)** A. Well, we haven't furnished any new set-ups for White in quite some time, but they have our machines.

Q. Chrysler? A. Yes, sir. There are one or two companies that have gone to casting cam shaft, and, of course, those machines aren't being used because they grind directly from the casting. Now, what companies have ceased to use the Walcott machine and gone to the cast cam shaft, I couldn't say.

Q. Do you know any other automobile companies that are now using the Melling machine? A. Well, of course,

the Muskegon Motor Specialties Company are using our machines.

Q. Can you recall offhand, or do you remember any other companies that are using the Melling machines? A. Let me see, the Hudson, I believe. I don't know. We have named a lot of the larger companies.

Q. Now, the Muskegon Motor Company, Motor Specialties Company, that makes only a cam shaft, does it not? A. I believe that is all they make.

Q. And they are still using your Melling machines? A. As far as I know.

Q. And, do you know whether that Muskegon Motor Specialties Company makes cam shafts for automobile and motor manufacturing companies? A. I don't know who they make them for.

Q. Would you have any information about or concerning the number of cam shafts that Muskegon puts out a year? A. No, sir.

Q. Now, you remember the time when you recommended to the Ford Motor **(958)** Company that they put on a new overhead cam when they started to manufacture their A models? A. Well, in the changing from a Model T to a Model A, it was absolutely necessary to change the overhead shaft.

Q. You made such recommendation to them, did you? Did I understand your testimony correctly? A. Well, the testimony I gave this morning was the fact they changed the shape of the nose of their cam on the Model A after we had laid out the overheads which necessitated a new set of overhead cams being made.

Q. Did your company, or do you know whether your company made that new set of overhead cams? A. Yes, sir, we did.

Q. You did. For all the machines? A. As far as I know.

Q. Do you know how much stock your machine took off the cams on the T cam shafts? A. No, sir. Of course, that varies with the condition of the forging dies. When the dies are new, why, the machine would have to take off less stock than when the dies became worn.

Q. And, how about the F shafts, the tractor shafts, would you know how much your machine took off? A. No, sir.

Mr. Spohn: That is all, Mr. Hunt.

The Master: That is all. Wait a minute, do you have some more questions, Mr. Farley?

Mr. Farley: Just one question.

(959) Re-Direct Examination by Mr. Farley.

Q. I think I showed you this morning one of these purchase orders, I don't know whether this is the particular one, but I am now showing you two purchase orders. I will show you the one, Exhibit 219, for 15 Melling cam turning lathes, and this purchase order states, "For operating above 15, 5 horsepower, 1150 R.P.M. Westinghouse motor," and so forth. That was the type motor specified and that was the type recommended for you and upon which the calculations which you gave this morning are based? A. Yes, sir.

Q. When you saw the machine out in the Highland Park plant recently, did it have that same motor on or type of motor, or what did you notice, if anything, about the R.P.M.'s of the motor? A. I think it is an 1100 R.P.M. motor on the machine at the Highland Park plant at the present time, and that would, of course, tend to slow down the speed, slow down the speed in proportion to the percentage of drop in speed.

Q. That is, the proportion of 1100 to 1150? A. Yes, sir.

Mr. Farley: That is all.

Mr. Spohn: One more question, Mr. Hunt.

Re-Cross Examination by Mr. Spohn.

Q. Does your company sell much merchandise of any type to the defendant, Ford Motor Company? A. Well, we haven't sold them practically any in the past year, I believe.

(960) Q. Prior to that time? A. We have sold them considerable equipment at times.

Mr. Spohn: At times. That is all.

Re-Direct Examination by Mr. Farley.

Q. Would the fact that your company sold any merchandise to the Ford Company, in any way influence or modify your testimony? A. No. I just gave the testimony

as the machine was actually designed, and it couldn't change that.

Mr. Farley: That is all. You have no interest in this proceeding?

A. No, sir.

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(962) Henry G. Pillinger thereupon resumed the stand as a witness on behalf of the Defendant herein, and having been previously duly sworn, testified as follows:

Direct Examination by Mr. Farley.

Q. Your name please? A. Henry G. Pillinger.

Q. You are employed by the Ford Motor Company, Mr. Pillinger? A. Yes, sir.

Q. And you live where? A. 924 Lincoln Boulevard, Lincoln Park.

Q. That is a suburb of Detroit? A. Of Detroit.

Q. How long have you been employed by the Ford Motor Company, Mr. **(963)** Pillinger? A. Well, since 1925. That is about—

Q. And, in what capacity were you? What was your job with the Ford Company in 1925? A. Well, I started in the tool room there and I did about four months there, and then I was transferred on to the cam department, on the Walcott lathes.

Q. Have you ever served an apprenticeship, Mr. Pillinger? A. Yes, sir.

Q. And, when and where did you serve your apprenticeship? A. In England.

Q. To learn what trade? A. Tool making.

Q. Tool maker and machinist? A. Machinist and general tool maker.

Q. After you worked in the tool room at the Ford Company in 1925, how long did you work there in the tool room? A. Well, about—I started in the tool room about February, and I worked there about three months.

Q. And then what department? A. Then I was transferred into the cam department.

Q. And, just what were your duties in the cam department? What was your job over there? A. Well, I went

out there to work on the Walcott lathes, and after I had been there a while, I was put in charge of the job.

Q. What part of the job were you put in charge of? A. Maintenance of the Walcott lathes.

Q. And, just what was the work you did in maintenance of the lathes, **(964)** repairing the lathes when they were broken, and things of that sort? A. Broken down, and—

Q. (Interposing): How many men did you have working under your supervision when you were in charge of that job? A. Well, there were about four men on each shift; four men on days, four on afternoons and midnight we ran around three, I guess.

Q. How long did you work on that job of maintenance for the Walcott lathes? A. Well, I worked on it until we quit running the machines.

Q. And, when did you quit running the machines, if you know? A. I think it was about 1931, as far as I remember.

Q. What type of shafts were the Walcott lathes machining in 1925 when you first went there? A. Model T's.

Q. And, did they continue to machine Model T shafts until the time they discontinued—did you always make Model T shafts on the Walcott lathes? A. Yes, sir.

Q. Until Model T production stopped? A. Until they stopped.

Q. And then what did you machine on? A. We went on the Model A's then.

Q. Now, after you stopped using the Walcott machines, what then did they use to machine the cam shafts? A. The mills, the Pioch mills, was it?

Q. Was there anything in connection with the stopping of the use **(965)** of the Walcott lathes that was in any way unusual or would enable you to remember the facts as to when and how they stopped using them? A. Well, they just, as the mills come in, they discontinued to use the lathes.

Q. And, what is your recollection, if any, concerning the date when they stopped using the lathes? Was that after all of the mills came in or— A. (Interrupting): No. I think as the mills came in, we began to use them.

Q. Did you have anything to do with, any work to do in connection with the Walcott lathes when the mills would come in and the Walcott lathes would be moved out? A. In the way of repairing?

Q. Well, what I have in mind, you in charge of the machines there, if an order came in to move the Walcott machines out, would you or any of your men do anything with those machines before they were moved out of the shop? A. Well, no. When a machine was got in a bad shape, we generally ship one to the shop for overhauling.

Q. How often did you overhaul the Walcott machines? A. You mean a complete overhaul?

Q. Yes. A. Well, as a rule we had one in the shop at a time. They would send one in there, and they would overhaul it, and when it came back we would send another one in.

Q. You would keep one machine in? A. We would keep one in there all the time.

(966) Q. All the time? A. That is right.

Q. Did you have anything to do at any time at all with dismantling a number of the Walcott lathes, taking the overhead, as they call it, off? A. The cam shafts and slides, you mean?

Q. Yes. A. Oh, yes. We used to have to do that, take the slides out and to do that we had to pull the master overhead shaft out, you see.

* * * * *

(970) Q. I understand you have been actively engaged in the repair and charge of those machines from the period 1925 until 1931? A. Yes, sir.

Q. And, during that period of time, did every one of the machines that were in that department come under your personal observation? A. You mean the cam lathes alone?

Q. I mean the cam lathes alone. I mean would there be any—wasn't it really a part of your duties to more or less know what each and every one of those machines were doing insofar as their operating condition was concerned? A. Yes, sir, it was my job to see they were kept running.

Q. So, you observed the operation of all of that battery of machines during their entire period of use at the Ford Motor Company? A. Yes, sir.

Q. And, would you say that the operation of that machine in Highland Park was in any way different from the regular operation of those machines during that 1925 to 1931 period? A. Not to my knowledge.

Q. Now, during your operation of that machine, a certain part of the cycle, one of the parts of the machine broke? A. Yes.

Q. Will you tell the Court just what happened then at that time; just what it was that broke? A. It was the overhead spring that kept the tool, the tool on to **(971)** the cam, on to the tooling cams. This is the spring (indicating).

Q. Just a minute. I have here a plate model, Mr. Pillinger, which is marked Defendant's Exhibit 140. Will you first state whether or not that shows correctly the operating parts, the main operating parts for making the cam the right shape of the Walcott machines, aside from the fact that this is just out of place? A. Yes, sir. This is a similar machine; similar model.

Q. Now, you spoke of a spring breaking, and you pointed to a small spring on this model, the lower end of which is connected to the tool holder, which is marked with a reference number "15"? A. Yes, sir.

Q. That is right, isn't it? A. That is right.

Q. Now, will you state whether or not the breaking of the spring that occurred there was anything particularly unusual insofar as the operation of those machines are concerned? A. No, sir. We very often have those springs break.

Q. Now, when those springs broke, in your experience with the machine, I understand from—in this particular case when that spring broke, did it do any damage to any other parts there? A. Well, it didn't at that time, because I stopped the machine pretty fast.

Q. How about the cam shaft or the working shaft, did you notice— A. (Interrupting): Well, it dug in a little on the work shaft, but it didn't break any other part.

(972) Q. If you had not stopped the machine so quickly, would any further damage have occurred? A. Well, we had then, when those springs break they break this here—the tool holder here.

Q. Part 15? A. Yes.

Q. Did that very frequently occur? A. Yes. That was one of our troubles with those springs breaking.

Q. Did you have any other major repair difficulties with the Walcott machines? A. You mean from a broken spring or any—

Q. (Interposing): I meant from any other cause? A. Well, the slides were our main troubles. These slides here (indicating).

Q. And, by these slides here you are referring to the part colored green in this model and marked "11"? A. That is right.

The Master: What trouble did you have with the slides?

A. Well, we had continually to keep them clean. They fill up with dirt and chips and, of course, that would give us a bad cam shaft.

The Master: How often when the machines were used in regular production, would a spring on one of those machines break?

A. Well, sometimes we would have two or three a day break.

The Master: Two or three on all the machines?

A. On the whole, say, 16 machines, we had, I guess it was. And, other days we would probably g[illegible] a day with no break. It just **(973)** happened some days we got the whole thing.

The Master: Can you say anything as to the percentage of times that the breakage of the spring would also cause the breakage of the tool holder?

A. Well, that depended on the operator. If the operator was fast in stopping the machine, he may be able to save the tool holder. You see, when this spring did break, and this nose would come around here, you would very often hit on here (indicating), and cause this tool holder to break off here.

Mr. Farley: The witness, when he said, "this nose," he pointed to the nose, the high nose on the cam 21, and when he said, "the roller" (?) he was pointing

to the roller 20. Do you want to make any more explanation of that?

The Master: I wanted to get some rough idea. Would it be, say, once in every five times when the spring would break it would be followed by the tool holder's breaking, or once in a hundred times?

A. I would imagine it was more than that. If the operator wasn't very quick he would break it off every time.

Q. And, when the operator was running two machines, how would that affect that? A. Of course, that didn't help any. Sometimes the spring would break, and it would be gone before he could even get back to it.

* * * * *

(974) Q. Now, will you state whether or not there was any particular difficulties experienced with the machines when you made the changeover from Model T to Model A shafts? A. From the Model T to the Model A shafts?

Q. Yes. A. Why, yes, we had quite a lot of trouble there. Our main difficulties **(975)** was on the nose of the cam, we couldn't seem to get a good form on that.

The Master: Was this before or after you changed the overhead in the master cam that you had the difficulty?

A. It was while we were producing the Model A cam shaft.

The Master: Did you have the same difficulty after you changed the overhead?

A. Well, no. We never did change them. We changed them the once, but that is all we did do. We had to change the form—

The Master: (Interposing): As I understand, you operated the machines, or attempted to operate them on the Model A shafts with the same overhead at first that you had in turning the Model T cam shafts, and then the overhead was changed.

A. No, we changed the overhead as soon as we started on the Model A's.

Q. (By Mr. Farley): Would you, as a mechanic, Mr. Pillinger, attempt to produce the Model A shaft, using the same master cams as you had used on the Model T? A. No, I wouldn't.

Q. It just couldn't be done? A. It couldn't be done.

Q. Now, then, we just had a witness who testified that after the Model A job started, there was a change made in the design of the nose of the cam, and that it was necessary then, that after the change in the design of the nose was made, either increasing or decreasing the radius of the nose—you understand what I mean? A. Yes.

(976) Q. (Continuing): —you attempted or you continued to attempt to run the job with the first set of master cams for the Model A, and that you ran into difficulties, and then it was found necessary to change again the master cams in view of the change in the design. Do you remember anything about that? A. Well, of course, when making a new cam you may run into little difficulties while you are producing that master. What I mean to say is that we didn't quite change the cams after they once started on high production. While we were forming the master cams to produce that shaft, we probably did make changes.

Q. That is, there would be, before any change in one model to another, a certain development period in the department where you would be, let us say, fiddling and fooling around with cam shapes? A. That is right, to get the perfect cam.

Q. And, do you have any recollection of having done that with the Model A job that was made—did you cut and try with your cams until you got the best results? A. Yes, we did do that.

* * * * *

(981) Q. About, if you know, Mr. Pillinger, how often did you in regular production, have to change the tools on the Walcott machines? A. Well, it depends. Some days they would go a lot better than others, and I know some days they would change, perhaps, a half dozen times.

(982) Q. The entire set of tools? A. The entire set of tools.

Q. That would be on one shift? A. On one shift.

Q. That would mean you would change those tools about every hour and a half or hour and a quarter? A. That is right.

Q. What was the ordinary practice? How often did you change tools. Let us say, when things were going good; every two shifts, or one every 24 hours, or 48 hours, or what? A. At least twice a day.

Q. Twice a day. That would be about every four hours? A. About every four hours.

The Master: How much of a job was it? How long would it take?

A. I would say ten minutes between the time they were changed and set up again.

Q. (By Mr. Farley): That would be a change of all eight tools? A. Yes.

The Master: When you changed them did you make it a policy or a point to change all eight, if possible, instead of making a change of a single tool?

A. Well, sometimes one tool would break, and it all depended on how the job was going. If it was making a good job, you would look at your tools and you would leave them in there and just replace the one tool.

Q. (By Mr. Farley): How long,—the particular tools that were in the machine which you demonstrated at Highland Park, do you **(983)** know how long they were used in the machine without re-sharpening? A. You mean since we started that machine out there?

Q. Let me first ask you this. When you were told to go over and get that machine in running shape, did you change all the tools before you demonstrated the machine last Friday? A. Yes, sir.

Q. You did? A. Yes, sir.

Q. And, now, I think you said you took three tools out of the machine, one of them I happen to have in my pocket which was turned over to me, and I believe you have the other two.

(The witness thereupon produced the tools above referred to.)

Q. Will you just describe to the Court, the differences, if any, between those tools, and the reasons for the differences? A. You mean on the width? Well, this tool here—

Mr. Farley: (Interposing): Let us get some tags and we will tag these.

Q. (By Mr. Farley): While these are being tagged, you said that you always kept one machine down in the tool room for overhaul and repair. About how often was it, Mr. Pillinger, that you took any particular machine and sent it into the tool room? Let us say, just think of this machine that was out there in Highland Park, and that was in your production line. How often would it be that that particular machine would get into the crib, or wherever it was that you gave your general overhauling or repairs to them? A. Well, I figure about three weeks or a month, I guess they take to overhaul that machine.

(984) Q. How long would you spend on overhauling a machine when you got it in there? Would it be one day or two or three? A. No. It used to be in there probably three weeks for general overhaul. They used to overhaul the whole thing.

Q. Then, you would put that back on the line? A. When that was fixed, we would send another one.

Q. And, just go down the line until— A. (Interrupting): Keep coming around to the machines again.

Mr. Farley: I will ask that these be marked.

(An article was thereupon marked Defendant's Exhibit 243 by the reporter.)

Mr. Farley: Let us call the other tool Exhibit 244.

(An article was thereupon marked Exhibit 244 by the reporter.)

Mr. Farley: Now, the tool which we marked Exhibit 244 has etched on the side of it, "CM-1034-1," is that the way—would every one of those tools of that type have that same number on (handing article to witness)?

A. No, I don't know what that is there.

Q. (By Mr. Farley): Now, if you will refer to the tool which is marked Exhibit 243 and explain—let me say I notice that tool is very much smaller on the cutting nose of the tool than the tool which we marked 244. That is right, isn't it? A. Yes.

Q. Just explain the reasons for that, if you will, please? A. Well, the reason for grinding this tool in this way, it is for clearance for the center bearing. This is the

tool which we use on the cam just ahead of the center bearing, and if we **(985)** had the wide tool we wouldn't get a clearance. Right here, see (indicating).

Q. That is, because the space between the center bearing and the adjacent cam is very much closer together or very much narrower, rather, than for the other cams? A. Here is the way that goes (indicating).

The Master: You are indicating the cam, the number 4 cam.

A. Number 4 cam.

The Master: To the left of the center bearing as you face the machine?

A. And, also here on this one, number 8 cam.

The Master: Why is this tool, the tool Exhibit 243 you have in your hand, longer than the other one you produced, and notched?

A. Well, these notches are so that the man that is putting these tools in, so that he can get a hold of it with the pliers to pull them out. And, the length, these tools are worn more than this. This is about the original length of the tool. These are worn down, being ground several times.

Q. (By Mr. Farley): Referring to Exhibit 243, that is, you say, a newer tool than the other one, and hasn't been ground as many times? A. A newer tool; that is right.

Q. Do you happen to know about the number of grindings those tools would have before they are unfitted for use? A. Well, I figure they would have quite a bit of grinding because there is about one inch from this toe to this. There is about one inch difference in length, and they can grind this down until they get about one inch.

(986) Q. And, the reason for having the grooves in the side of the tool, Exhibit 243, is because there was less space for the tool setter to get in there so that he could grip that with the pliers, is that the idea? A. No, all the tools had this. I don't know why this hasn't got it, but it is probably ground the wrong side, and it was ground off before it was cut down so short.

Q. Now, do you know about how many shafts were turned with those three tools that you have in your hand, since they were last re-ground, since they were put in the

machine in a sharpened condition? A. Well, I should say around 50.

Mr. Farley: Will you mark this, please?

(An article was thereupon marked Defendant's Exhibit 245 by the reporter.)

The Master: For the purposes of the record, the short tool which doesn't have the grooves in the side, which has been produced by the witness, and which we have referred to, is Exhibit 244.

Q. (By Mr. Farley): Now, Mr. Pillinger, you mentioned one of your troubles, or one of the major troubles you had with the Walcott machine was with the slides, and that, as I understand your testimony, was due to the fact the chips would get into the slides and necessitate that they be taken down for regular cleaning and removing of the chips? A. Yes.

Q. How often was it ordinarily necessary to take machines apart and take the slides out to clean out the slides? A. Well, I figure the way I used to work, I would pull one machine (987) down a day; about eight slides out.

Q. And that would be— A. (Interrupting): By doing this we would keep the job running more even, you see, and I found before that some mornings I would go in there and probably find, say, two or three machines down even.

Q. Stuck? A. Stuck up.

Q. The tool slide stuck? A. And made it a practice to tear one machine down a day.

The Master: How long a job was that to take it apart and clean the slides?

A. Well, we did not clean the slides. We used to send them to the shop. But, it would take up about two and a half to three hours to take them out and replace them with others, and get the machine ready to operate again.

The Master: Did that include the time—oh, you replaced the slides with others?

A. We had slides ready to put in the machine.

The Master: As this machine is operating, where would the chips fly? In what direction?

A. They would fly around here. In fact, we had a guide in front to keep the chips from going back in; in fact, there was a felt in front of this tool holder here, a piece of felt.

Mr. Farley: That is all, you may cross examine.

I am not sure but I offer these tools in evidence, Exhibits 243, 244 and 245.

The Master: Exhibits 243 to 245 are admitted as being **(988)** tools used in the demonstration of the Walcott lathe.

Mr. Farley: Attention has been called to the fact, —I am pretty sure we put in and offered in evidence the cam shaft, Exhibit 234. I think that is in. I am not sure whether I offered in evidence the work sheets, 235 and 236 of Mr. Rauser. I think they were offered.

The Master: Yes, they were. I remember as far as the Walcott—or admission was withheld pending a showing the machine was in good operating condition. I will wait until the end of this cross examination to rule on that.

Cross Examination by Mr. Spohn.

Q. How long would it take to take out those slides in the Walcotts? A. Take them out and replace them?

Q. Yes. A. You mean to get the machine ready to go?

Q. Yes. A. Around about two and a half, three hours.

Q. How many men did it take? A. Two men.

Q. And, you did that on one machine a day, about? A. Yes, sir.

Q. When you say a day, do you mean a shift, or what? A. Eight hours.

Q. Eight hours. What do you mean when you say overhaul the machine? A. Well, that is a complete overhaul.

Q. Now, tell us what that meant? **(989)** A. Well, they replaced the clutch, probably; check the clutch, bearings; scrape the bed, probably, if it was needed, and give the machine a thorough overhaul.

Q. What else besides that? A. Well, you know, line the body on the machine, that works with the cam shaft.

Q. Look at the lining on that? A. They would probably line that up.

Q. And, what else? A. Well, I replace the pins, steady rests, and center bearing on the cam shaft, and the two end bearings on the cam shaft; that is, the master cam I am talking about.

Q. You say you had one machine in the tool shop for about three weeks, is that right? A. About three weeks.

Q. And then, you would bring another machine in? A. That is right.

Q. That is, each machine was in there about once a year? A. Well, according to that, yes.

Q. Did you ever work on any other machines other than the Walcott machines? A. Yes, we had other machines around.

Q. What other machines did you work on other than the Walcott machines? A. You mean—

Q. In overhauling? A. Well, we had centerless grinders.

Q. How many of those machines did you look after? A. About a half dozen, I guess.

(990) Q. Did you overhaul them, too? A. No, sir.

Q. Who did the overhauling work on them, do you know? A. You mean the general overhaul?

Q. Yes. A. They never went in the shop for general overhaul.

Q. What other machines did you do that work on? A. Let us see, there was wrist pin machines there.

Q. How many of those were there there? A. About a half dozen.

Q. Did you work on those, too? A. Yes.

Q. That was during the time you were working on the Walcotts? A. Yes.

The Master: Did I understand you to say you actually did the overhauling work on the Walcott lathes?

A. Yes.

Q. (By Mr. Spohn, continuing): And these centerless grinders, they were there when the Walcott machines were there, were they? A. Yes.

Q. And you had those under your charge, too; did the repair work, did you? A. Yes. We didn't have to do much to them. There wasn't much overhauling to them.

Q. But, on the ordinary repair work? A. Any little job we would do, yes.

Q. What other machines were under your supervision? A. That is about all I have.

(991) Q. And you had how many men under you? A. Four men a shift.

Q. And those four men worked on all those machines, did they? A. Yes.

Q. And did all the repair work that was necessary on all those four machines, on all those machines? A. Yes.

The Master: Were those four men spending all their time on repair work and maintenance?

A. Yes, sir.

The Master: None of those men operated those machines at that time?

A. No, sir.

Q. (By Mr. Spohn): Did those four men work, sometimes work in the tool shop? A. No, sir. Only when production was shut down. They would come in, probably, on a Friday, and that was all, and go in there for a day, perhaps.

Q. Who did the tool changing on the Walcott machine? A. Change the tools?

Q. Yes. A. They had a tool setter there.

Q. The operator didn't do that himself, did he? A. No, sir. In fact, they had two there, as far as I know; two tool setters.

Q. In the meanwhile he was running the other machine, then, the operator was? A. You mean the tool setter?

(992) Q. No, when the tools were being replaced, the other machine— A. (Interrupting): He would be running the other machine.

Q. He would be running the other machine? A. Yes, sir.

Q. All during that time? A. Yes, sir.

Q. Those tools that have been offered in evidence here as Exhibits 243, 244 and 245, where did you get those tools, do you know? A. At Ford Motor Company. I ordered them.

Q. Did the Ford Motor Company make them themselves? A. No, sir. They had them in stock.

Q. They had them right in stock there? A. Yes, sir.

Q. Still have some of those tools, do they? A. As far as I know. I couldn't say whether they have or not.

Q. Do you know whether the company made those tools, or whether they were purchased? A. I couldn't tell you that, sir.

Q. One of these tools has a mark on it, I think it is Exhibit 244—no, that isn't the one I had in mind—Exhibit 245 has a mark on it, "9-Z-215-D-1," does that mean anything to you? A. Why, that is the "Z" number of the tool. Every part you get has Z numbers on it.

Mr. Farley: What do you mean by a "Z" number, do you know?

A. That is a number you order another tool from, if you need one.

Q. (By Mr. Spohn): Doesn't the number "Z" mean anything in the defendant's production? I mean, doesn't the Ford Motor Company make "Z" numbers themselves? A. Yes. Every part you get is under a "Z" number. Every part in **(993)** a machine has a "Z" number on it.

Q. Whether the machine is made by the defendant, or whether you got it somewhere else? A. Well, what do you mean? Tools or—

Q. Tools? A. Yes, nearly everything is "Z" numbered. If it was sent outside to be made, there is a "Z" number on it.

Q. Doesn't that "Z" number mean the Ford Motor Company made those tools themselves? A. No, sir.

Q. It does not? A. No, sir, not to my knowledge.

Q. Would you know where the tools were gotten by the company? A. Would I know?

Q. Yes. A. I couldn't tell you.

Q. You wouldn't know? A. No. I don't purchase the tools.

Q. What department are you in now, Mr. Pillinger? A. I am in 641, the connecting rod.

Q. The connecting rod department? A. In the motor building.

Q. Are you on a machine there now? A. I am still maintenance.

Q. Still maintenance man? A. Yes.

Q. When you were running this Melling machine out there last Friday, two springs broke within an hour. You noticed that, did you? **(994)** A. Yes, sir.

Q. That was unusual, wasn't it, in your experience? A. Well, it was in mine, because I don't run the machines all the time, but during the period of those machines, we had a lot of springs break.

Q. But, your testimony on direct examination was sometimes some machines would run a day without breaking springs? A. Yes, and sometimes you would get three or four breaking a day.

The Master: Were you referring to the entire battery of machines when you said they might run a full day without breaking?

A. Yes.

The Master: Or, just a single machine?

A. No. I mean a single machine.

The Master: Not all 16 machines?

A. No, sir.

Q. (By Mr. Spohn): Haven't you changed your testimony on that? Didn't I understand you to testify on direct examination that sometimes they would run a whole day, all 16 machines, without any break in any of the springs? A. I don't know what I said.

The Master: I think when he was referring to all 16 he was talking about the change of tools, rather than springs.

Q. (By Mr. Spohn): At any rate, wasn't it unusual to have two springs break within an hour in the operation of that machine out there last Friday? A. I beg your pardon.

Q. Wasn't it unusual in your experience to have two springs break within an hour on that machine? **(995)** A. No, sir. We have had that before several times.

Q. Within an hour? A. Yes, sir.

Q. Some days they would run, as you say, without a spring breaking on a machine? A. Yes.

Q. And sometimes maybe two springs would break during the whole day? A. Yes.

Mr. Farley: On the one machine you are referring to now?

A. Yes, sir.

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(999) Q. Did you make overhaul records? A. No, sir.

Q. You didn't? A. We used to get an order to overhaul certain machines.

Q. And those were the only ones you overhauled? A. In fact, it was a standing order to repair the machines.

Q. To repair the machines. But, how about overhauling? A. Well, overhauling, whatever you want to call it.

Q. And, you got a standing order for that? A. Yes.

Q. What do you mean by a standing order, was it every three weeks? A. Well, they got the standing orders for all machines—like the job I am on now. I got a new order about every, say, probably two months, and any overhauling work that has to be done on (1000) that machine is done on this particular order. It is made up by the office.

Q. Is that a written order? A. It is a written order.

Q. Were these machines taken into the tool shop for overhauling without a written order on any occasion? A. Not that I know of.

Q. Every time they were overhauled, there was a written order, is that right? A. Yes, sir, as far as I know. Any machine that is moved from the department, there is always a written order on it before they ever move it.

Q. So, you never took it out of production to go into this tool shop without a written order for it? A. Not to my knowledge.

Q. And, all the other repair work you did was right on the floor? A. Just on the floor, yes.

Q. Yes. Who furnished the tool holders, do you know, when they broke? A. Well, I don't know whether an outside company made the standing order on the tool holders, but I think in case of emergency we would make them up, make one up, probably, if we didn't have any at hand, you see.

Q. But, you say the greatest difficulty you had with these machines was the breaking of the springs, is that

right? A. Yes. Not the greatest difficulty, no; the slides was one of the main troubles. I wouldn't say that was the most important difficulty, the spring.

(1001) Q. And, you clean the slides out of one machine a day on an average? A. In a day.

Q. And, I understood you to say you never operated one of these machines in the production line at all? A. Not on production; no, sir.

Q. Do you know whether or not when this machine was pulled off of production in 1931, whether it had been overhauled recently before that time or not? A. Well, it probably had to be overhauled in its term, but I can't remember whether there was any overhaul on that special one machine.

Q. But, anyhow, if there was an overhaul, there was a written order for you to do the overhaul? A. Yes, sir.

Q. Now, by this standing order that you say you had, what was the form of that order? Where would you get it when you had to overhaul a machine? A. Well, it would come from the superintendent's office.

Q. And, would it be on a printed form, or something like that? A. A piece of paper. Not paper; kind of a card.

Q. Would it tell you what was to be done? A. Well, it would say keep so many machines in running order, or in condition for a certain period of time.

Q. And then would that cover a given period. That is all? A. No, sir; no given period. What I understand with the standing order like that, as soon as you finish—if so many days of a certain period of time elapses without making repairs, they close the order, and then you have got to produce another.

(1002) Q. And, you made no written record of whatever overhauling you did to these machines? A. No, sir.

Q. Never did? A. No.

Mr. Spohn: That is all, Mr. Pillinger.

Mr. Farley: Just a few more questions.

RE-DIRECT EXAMINATION by Mr. Farley.

Q. Who was your immediate foreman, Mr. Pillinger, on that job? A. Well, John Schmidt. He was the foreman over the whole department there.

Q. In connection with your testimony about the blackboard and that sort of thing, suppose that a department was not able to get out cam shaft production, cam shaft turning, because your cam shaft lathes were down for repairs, or were breaking too frequently, would you ever be hauled on the carpet for that? Would they get after you, say, Al Smith? A. Well, they naturally—

Mr. Spohn: (Interposing): Just a moment, I object to the question, would he ever be called. It is all right if he limits it to was he called.

The Witness: Never.

Q. (By Mr. Farley): In connection with your testimony about having the six, about half dozen centerless grinders and about wrist pin machines, you stated as far as the centerless grinders were concerned, you never had any complete overhauls on those. How about the wrist pin machines? Did you have to completely **(1003)** overhaul them like you did these Walcott machines? A. It was just a matter of lining them up. We did not do much repairs on them, just the V blocks. We had to line them up once in a while.

Q. What proportion of the time would you say you and your crew had to devote on the wrist pin machines and centerless grinders as compared with the Walcott machines? A. Well, half hour or an hour a day, I guess.

Q. One man? A. Yes.

Mr. Farley: That is all.

Re-Cross Examination by Mr. Spohn.

Q. How much time did you spend on these centerless grinders each day?

Mr. Farley: He said about a half hour for both.

A. About a half hour or hour.

Q. (By Mr. Spohn): And, how much on the wrist pin machines? A. About the same.

Q. That is each one? A. Yes.

Q. Or, each machine? A. Yes.

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Q. (By Mr. Spohn): You had four men, and there were 16 Walcott **(1004)** machines? A. Yes.

Q. And, there were 6 centerless grinders and 6 wrist pin machines, and that was all that was in there? A. That is about all, as I can recall.

Q. And, you don't recall any other machines you had anything to do with? A. No, sir.

Q. During that period? A. No, sir.

Q. Do those men give all their time to that department in which those machines were located, the four men under you, and you? A. Oh, yes, sir.

Q. Can you tell us, again, how much of your time was spent on these centerless grinders, you and the four men? A. Well, about half an hour or an hour. That wasn't really my job but we used to go over there. If those jobs come up, we would fix it up.

Q. Was that on each machine? A. No, just on the whole job.

Q. And, about your wrist pin machines, how much time was spent on them? A. About an hour, I guess; about the same time.

Q. And on each machine, or on what? A. Well, it amounts to a whole group of machines.

Q. And, when you say an hour, was that each man spent an hour? A. Oh, no; just say one man go over there for an hour and do a little lining up, or something, and that would be about all.

(1005) Q. And did those same men do the overhaul work on the wrist pin machines? A. Well, we didn't have much overhaul on those machines; not as regards to maintenance on the floor.

Q. But your men did whatever overhaul work was done on them? A. No, those machines were taken out when they were worn very bad.

Q. Oh, when they would get worn very bad they would be taken out of the department? A. They would be overhauled or taken out and another machine brought in.

Q. Are you familiar with any of the other departments of the defendant company than the one you are in? A. 641.

Q. That is the only one you know? A. Yes, sir.

Q. Was that the cam shaft department? A. That is the connecting rod; I am still in that department.

Q. Go back to the time when you used to be in the cam shaft department, 410? A. Yes, sir.

Q. Are you familiar with any other operation, machine operation, other than the turning operation and the operation performed by these centerless grinders and the wrist pin machines? A. No, sir. I was in that one department.

Q. That is all you know? A. Yes, sir.

Q. Do you know how many maintenance men were in any other portion of the department than 410? (1006) A. No, sir.

Q. You have no knowledge of that at all? A. You mean the grinding end?

Q. Whatever you do know about, maintenance and those other things. A. I guess there were two or three men down in the grinding; couple of men, perhaps.

Q. Down in the grinding room. Do you know any other operations in which there were maintenance men? A. Well, there are maintenance men over there on different operations.

Q. Do you know how many maintenance men were kept in the whole department? A. In the 410 department?

Q. Yes, per shift? A. There may have been about six or seven.

Q. I beg your pardon? A. There may have been about six or seven.

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(1009) JOHN L. SCHMIDT was thereupon called as a witness on behalf of the Defendant herein, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. What is your name, please? A. John L. Schmidt.

Q. Where do you live, Mr. Schmidt? A. What is that?

Q. I say, where do you live? A. Highland Park; 193 Hill Avenue.

Q. And, you are employed by the Ford Motor Company? A. Yes, sir.

Q. How long have you been employed by the Ford Motor Company? A. Since 1916.

Q. Did you ever serve an apprenticeship, Mr. Schmidt? A. Not here. I did in the East.

Q. And where? A. E. F. Sturdeman Marine Engines.

Q. To learn what trade? A. Machinist.

Q. And, when you went to the Ford Motor Company in August, 1916, what was your job there? A. I worked in the tool room; the front tool room.

Q. What particular type of work, if any, were you assigned to there? **(1010)** A. Well, when I first started in for the first two months I took care of all of the fixtures in the transmission department, and then after the first two months I had the job assigned to me to take care of all the cam shapers in Department 410; that was the cam shaft department.

Q. And how long did you work in Department 410? A. All but the first two months I have been in the employ of the Ford Motor Company.

Q. You are still employed in that department? A. Yes, sir. That and 498, both.

Q. And, what are your present duties at the Ford Company? A. Sort of maintenance, taking care of the machines, tools and fixtures.

Q. In Department 410 and? A. 498 and 410.

Q. And, are you in charge of that maintenance work? A. Yes, sir.

Q. How long have you been in charge of it? A. Well, for the bulk—first one department was over at Highland Park, I just took care of the 410 at that time. When they moved out to the River Rouge, they gave me the both departments to take care of, which was in 1916 in Highland Park until October, 1925. I think it was November of 1924, I think I left Highland Park and went to the Rouge, and then they gave me the both departments to take care of from then on.

Q. And, your job at the present time, and for the last 22 years, has been that of maintenance, which is to see to it that the machines are kept in proper running condition? **(1011)** A. Yes, sir.

Q. In connection with this work of yours of maintenance, is any part of your job to observe or know what the output of the various machines would be that are under your supervision? I mean, their production per hour? A. No. The production part wasn't really under us. My

job was to chiefly see that the machines ran and was kept in the best running condition that was possible, and if possible to improve on them as much as possible to keep them running.

Q. When you took over the cam shaft department 410 in 1916, what type of machines was the Ford Company then using in the department to machine the cams of the cam shaft? A. They were using a shaper at that time when I was in that department.

Q. And did you ever have any reason to note, or know, whether those shapers operated efficiently on that job? A. Yes, sir, they ran very well, indeed.

Q. How long did the company use these shapers, to your knowledge? A. Well, the first one—of course, I wasn't there, I didn't go until 1916, when I went to the Ford Motor Company, and I think they had about 3 or 4 shapers in that department at that time.

Q. When you went there? A. When I went there. But, they kept increasing as time went on.

Q. And, now, how long did they use the shapers? Let me see, what is your best recollection as to the largest number of shapers you had operating in that department? A. I think, if I remember right, we had 14 when we finished, and we **(1012)** had an order let out to the Walcott lathe people to build, I think, 3 or 4 of them, but that order was cancelled. And, we left about 14 shapers in the department, and instead of going through with the ones that they had an order for in Jackson, they cancelled the order and they bought 16 Walcott lathes through the Ford Motor Company, and I believe two of them and a demonstrator were sent to demonstrate the machine at Highland Park, and this demonstrator operated, if I remember right, I think about 2 weeks, and in the course of less than 2 months, I think the whole 16 Walcott lathes was in Highland Park plant, and they removed the shapers out of the department and put all those Walcott lathes in their place.

Q. Now, you had charge of maintenance of the shapers during all the time from 1916 on? A. Yes, sir.

Q. Until they were removed? A. Yes, sir.

Q. And, did you also have charge of maintenance of the Walcott machines when they were removed? A. Yes, sir, I did.

Q. And, what is your recollection of the date when they got the Walcott machines? A. Well, not to be exactly sure, I think it was in 1924, somewhere around March. It was somewhere around that period. I am not positive, but I think that was about where it was.

Q. How long, if you know, did the Ford Motor Company continue to use the Walcott machines; from 1924 until when? **(1013)** A. Well, they moved them out of Highland Park plant, I think it was in November, and moved them all out of there.

Q. November of what year? A. To the Rouge—1924. They went to the Rouge, and while they were at the Rouge they put the shapers back into running condition to keep up their production until they got these Walcott lathes shipped to the Rouge factory and set up, and running, and I think after they were down there a month or two, they wanted me down there to take care of them the same as I did at the Park.

Q. That is at the Rouge plant? A. Yes. So, I went down there, I think it was before Thanksgiving, or around in November, 1924, and they had the biggest part of the machines down there, when I went down there; after being down there, for, oh, a month and a half or month to a month and half they were there, so they kept calling up and calling on the 'phone to the head superintendent, a man by the name of Nichali, who had charge of the front tool room there, and he came to me one day and said: "Well, John, you have got to go to the Rouge," and I said, "All right."

So, then, I went down to the Rouge, and I was taken over to the foundry tool room, to a man by the name of Mr. Brown who had charge of the foundry tool room, and he said, "You are the man from Highland Park, come out here to take care of this job."

And, I said, "I am."

And, he said, "All right, I will take you out and show you where they are." He said, "We have had an awful lot of **(1014)** trouble on them and we can't get the production on them," and, he said, "I wish you would get right into them and see what you can do to get these things going."

Q. That is the Walcott machine? A. That is the Walcott machine.

Q. That is the time you were removed from the Highland Park to the Rouge? A. Yes. So, I went right into them and in a short while, couple of weeks' time, I had gone over them with the men I had out there, and we got them in running condition, and it wasn't but a month or so that we changed over from what we were accustomed to running —we were running, when we got the machines, with soda water, and I had that changed and had a bracket and pump put on the machine, and run it into oil, and I found from then on after running the machines into oil that I got better results out of them than I did from the other.

Q. How long did you operate those machines, or had charge of the maintenance of those machines, in the Rouge plant? A. Well, I had charge of them as long as they had them up until the time they issued an order to tear all those machines down and to dis-assemble them, and to use the mills that they brought in. They had some mills there. So, they discontinued them, but just exactly when they did that, I couldn't recall. I think it was somewhere around 1927 or 1928. I am not positive. I won't state for sure.

Q. Those machines were dis-assembled by you? A. Yes, sir. We tore all the machines apart and piled them in one corner in, I think it was, about L-6 of the Motor Building. They were all put in a pile, all of them. There were eight **(1015)** slides that went on each machine, and all those 16 machines, I am quite sure were all piled in one pile right in that location. That left just the bed of the machine.

Q. When was that with reference to the time the Pioch machines, or the mills, came in? Was that before or after the mills came in that you tore those machines out? A. No, I think we had one or two of the mills in there then. I am not so sure.

Q. How many of the milling machines did you have in the department on the Model A production, do you remember? A. I think we had about 7; somewhere around there. I am not positive of that. That was mills?

Q. Yes, the Pioch mills. A. Seven or eight of them, I think; right around seven, seven or eight.

Q. Was the change made from the Pioch mills, or rather, from the Walcott machines to the Pioch machines, was that made during the time you were on Model T produc-

tion, or Model A production, do you remember? A. No, that was on the Model A's.

Q. That was on the Model A's? A. Yes.

Q. Now, what was your experience, Mr. Schmidt, with reference to the maintenance on the shapers? Did you have any great amount of troubles in maintenance on these shapers? A. Well, of course, I used to have a couple of men on an afternoon shift, and probably one on a midnight shift, and I had a couple on day shift that worked on the shapers, and they were gone all over from top to bottom as I stated. One machine **(1016)** had to be overhauled about once a year.

Q. How about— A. (Interrupting): Of course, there were little minor things that happened, screws breaking, or something like that.

Q. What was the situation so far as the number of men that had to keep on the job to keep up maintenance on the Walcott machines? A. Well, on the Walcott lathes, when they first came down to Highland Park they smashed so fast down there, and they were constructed so poorly, that the material that there was in them wouldn't hold up for the way they wanted the amount of work taken out of them over at the Highland Park; they had quite a few men, as much as four or five men, probably, on a shift there in Highland Park, and we had, in fact, to re-design a good deal of the stuff all over before we started to get any results whatever.

Q. How long after those machines first came in did it take you to make the necessary changes in material and parts in order to get them running properly? Is that a matter of weeks, or months, or how long was it? A. Well, I would say they came in there in March and—I tell you about five or six months before we ever started to get anywhere near production to what we ought to get.

Q. And yet you got fairly good production within five or six months of operation of those machines? A. Not as much as we would like to have had, but after we made the changes we kept increasing and got better production out of it, after we got to the Rouge. Of course, when you take those slides that was made of cast-iron, and the amount of work that they had to stand up to, they broke a great deal of them, **(1017)** and we came to the conclusion that we were

better off to make them out of steel. We made them out of steel, and we didn't have any more trouble with these slides outside of them scoring and being replaced by bushings that went through these slides.

The Master: How long after the original installation of the machines did you make that change from cast-iron to steel?

A. Oh, I should say about three months.

Q. (By Mr. Farley, continuing): Do you know how long it took you to change all the machines over in those three months? That is, do I understand by the end of three months you had all of the 16 lathes changed over? A. No, we didn't. We had to go gradually along with them. We sent right to Jackson, and we bought a good deal of those slides, we had them make the slides from cast-iron to steel, and we bought eight at a time from them, and I think we paid in the neighborhood of $150 a slide, or $1200 for a set of 8 slides. I think, if I remember right, that was the cost of the steel slides, and the replacement of the cast-iron slides. Just exactly how many sets of them we bought from them, I couldn't tell you.

Q. After you changed over the slides and during the continuous running of the machines up to the time they were discontinued, was there any particular change in the number of maintenance men you had to keep in the department to keep the machines running? I think you said four men, four or five men on the shift, or something of that kind. A. Well, we had between 3 and 4 men on the day shift and afternoon **(1018)** shift, and I think there was about one man, because they didn't have the production, on the midnight. That was called the No. 1 shift. That was in the production department. But, now, that is speaking where they turn the cams, you know, out there; that was the amount of men there. But, in the foundry tool room, when I tore these Walcott lathes down, the stuff was put onto a hand truck and carried over to the foundry tool room and brought over to the bench to tool-makers that we had in the tool room working. I had a couple of men working on the bench and they took these slides apart, cleaned them up, and whatever they needed, if they needed going over or brushing up, new bushings and scraping them up, tapping holes in where the set screws were. That was

taken care of extra besides the amount of men we had out in the production department. There were two men in the foundry tool room.

Q. In the foundry tool room did you have a couple of men on each of the shifts, or just on the day shift? A. No, day and afternoon.

Q. Day and afternoon? A. Yes. And, the midnights, they didn't bother much.

Q. And those men, as I understand your testimony, they would have some trouble with the slides and you maintenance men in the department would yank the slides out? A. And take them out to the foundry tool room and overhaul them, and get them ready, and when they were ready they were sent back to the production department, and when they had any more trouble they transferred them back and forth that way.

Q. You endeavored, I assume, to keep a stock ahead all ready to **(1019)** re-insert? A. We always had between four and five extra sets on hand in order to replace them.

Q. Were you in charge of maintenance in the department, Mr. Schmidt, when the change-over was made from the model T to the model A? A. Yes, sir, I was.

Q. Were there any particular defects experienced when you made the change-over from model T? A. Of course, the model T was a much smaller cam, and they weren't so particular with the hole, I think, in the model T as they were on that model A, and we had a little more difficulties to run into with the model A than we did with the model T, and, I think also, the model A was a much longer cam than the model T.

The Master: Had more of a lift?

A. Yes, had more of a lift. Therefore, we couldn't get the production on the model A that we could on the model T and we had to cut down on the amount of speed on the machine to overcome a good deal of that. If I remember right, I think at the time they had 1,750 R. P. M. motor on that, and I think they cut it down to 1150 R. P. M. motor on there when they changed over from the model T to the model A.

Q. Could you state, or do you know what the average production was per hour that you got off of the Walcott machines on the model T shafts? A. Well, of course, that

came mostly under the foreman of the production stock, because I was around there, and if they didn't get their production I was the one to hear about it, **(1020)** because I would—if the machines were down too long, they couldn't get the production, and they would always jump on me if I held the machine up so that they couldn't get it. So, in that way, if I remember right, the model T's you want?

Q. Yes. On the Walcotts. A. I think they got around 30 an hour or so; around that.

Q. How about model A production, what is your recollection? A. When they cut down that motor down there they didn't get as many model A's as they did the model T's. I think it was in the neighborhood of, probably, 23 or 25 an hour.

The Master: You say they had a 1750 R. P. M. motor on each one of the model T machines?

A. On the Walcott model T, and I think that was cut down to 1150 R. P. M. on the model A. To make sure, I think you can go out to Highland Park and see—I think they got a machine out there now with a motor on it. I think, if I remember right, it is 1150 R. P. M. on them.

Q. Were there any more difficulties so far as maintenance problems were concerned with the machines upon model A production as compared with model T? A. Of course, until they got the forgings right down to what they wanted, the form of the cams on them—that is the size wear-off—they had to keep working these cams down until they got the right shape they wanted, and after they got it exactly the right formation of the cam they wanted, there wasn't as much stock left on them as there was at the beginning, and they didn't have as much stock on there. Therefore, they did not have as much trouble with their tool bits, and didn't **(1021)** wear the machine as much.

The Master: You had three different speeds on the machines?

A. Yes, but two of them, the first and third, we never used. We always used the middle one.

The Master: Both in working on the model T and the model A you never used anything except the middle speed?

A. No. We just used the middle one; it had sufficient force on there; sort of pull it out with a plunger, and you could lower one set of gears up. There were three holes on an angle in the feed case.

Q. If any change had been made in the gears of those machines after they were purchased by the Ford Company from the Walcott Company,—let us refer back to the chain drive from the motor to the head stock. A. Do you mean the sprockets that went from the motor to the drive?

Q. Yes. If any changes had been made of that character would that have come under your supervision and attention? A. Oh, yes. If there were changes on the sprocket I would know about it but there were no changes made.

Q. And, the same would apply to the gears? A. In the feed case.

Q. In the feed case? A. Only replacements as they wore out; that is, a shaft or tooth out of the gear, or something like that. But, the style of the feed, that is the redesign of it, the gear case is just the same as it always was.

The Master: Would you be familiar also with any changes **(1022)** made in the motor from the time the machines were first purchased and installed?

A. In the motor?

The Master: Yes.

A. Any changes?

The Master: Yes.

A. I am quite sure it was cut down from the type T to A.

The Master: Do you know what the R. P. M. rating was in the motors originally furnished with the machines?

A. Well, if I remember right, they didn't furnish any motors at all. I think the Ford Motor Company put the motors in.

The Master: Do you know what motors?

A. I think they bought the 16 machines without any motors, if I remember right.

The Master: Then, what motors were originally put on?

A. I think the Ford Motor Company put their own motors on.

The Master: What was the speed of those original motors, do you recall?

A. I kind of think it was 1750.

The Master: And those motors were kept on until—

A. Until they made the change from the T to the A.

The Master: Were they continued for some time on the A until you found you were running into difficulty because of the excess speed?

A. When we first started we found we couldn't do it because we had too much of a hump on this point of the cam (indicating). It jumped over too much.

The Master: Was the motor changed on all those machines at once?

(1023) A. No. One right after the other. They had to keep the production going, and as fast as they got one down they would bring in another and change that.

The Master: It didn't take much time to complete the change?

A. Just disconnect the chain drive and take out the bolts that hold your motor on the machine, and replace it by the new one. I think, if I remember right, those Walcott lathes cost $3,000. They wanted $3,500 apiece, and the Ford Motor Company didn't give it to them. They put their own motors on for the $500 difference, and they bought them for $3,000 apiece, if I remember right. That is what they told me at the time when they were buying them, what they cost.

The Master: Do you know whether there is any written record kept of the type of motor put on the machines?

A. No, I couldn't say.

The Master: When the motors were changed from the 1750 R. P. M. to 1150 R. P. M.?

A. I don't know of any records at all. When they issued the order, they issued the order to the electrical department, and the foreman that has charge of the electrical department would send the motor down and take the old one off and replace that. That comes under the electrical department.

Q. (By Mr. Farley, continuing): Now, I think you spoke about you were overhauling the shapers about once a year? A. That is the general overhaul.

Q. That is the general overhaul? A. Once a year.

Q. Did you do any similar work to that on the Walcott machines? **(1024)** A. Of course, on the Walcott lathes, you see, they get going all the time; that is mostly on the slides and on that tool-holder bit.

Q. Did you keep any of your Walcott machines down at any time for overhauling? A. Yes. We always kept one of those down all the time; overhauled it while the others were running, to keep them up.

Q. What is the system as far as that particular type of overhaul that you are referring to with the Walcott machines, do you have any—do you get an order from any other department to do that type of overhauling work, or do you get any order at all, or is it done without any order? A. No. We had an order issued once every month to take care of that machinery in that department on the Walcott lathes. Every month there was an order issued to the foreman and he charged his time.

Q. You were the foreman to whom that order would be issued? A. Well, it would be issued to the head foreman from the ordering department.

Q. And the head foreman— A. (Interrupting): To the head foreman in the tool room, and he would pass them over to me, and I would get my orders to take care of them.

Q. And, that was your authorization to put the required number of men on the job to keep the machines running? A. Yes, sir.

Q. And would you be the one that would decide whether or not you would take the machine out of the line for a general overhaul? **(1025)** A. Oh, yes.

Q. Or, would that be one of your assistants who decided that? A. Well, if I was right there at the time and there were any difficulties, we would—the men themselves would get right into that and remedy it.

Q. Do you know Pillinger? A. Oh, yes. He worked for me.

Q. What was his—what did you say, he worked for you? A. He was my assistant. That is—

Q. (Interposing): What was his job in connection with these Walcott machines? A. To keep the machines in running condition.

Q. And, you put him in charge of three or four other men on the shift to keep things running? A. Yes.

The Master: How often would any one Walcott lathe be given a general overhaul?

A. Well, if the sides were sticking, or chips and one thing and another get in between the working parts, we would shut the machine right down and pull the slides right off and put a new set of slides right on. And, in that way they kept right on going.

The Master: Well, that wouldn't be a regular thorough overhaul of the machine?

A. Oh, no. The biggest part of their trouble was in the eight slides that went on the machine.

The Master: You testified that the Ford cam shapers were overhauled on an average of once a year?

A. Yes.

(1026) The Master: That was an entire overhaul?

A. Yes. The whole machine was taken right out of the production department, brought into the main tool room, and everything on it right down to the casting was taken off of it, cleaned and all gone over; new bushings, and new shafts, and—

The Master: You had a similar overhaul of the Walcott lathes at regular intervals, did you not?

A. Oh, we had a couple of them, you see. We always had a couple that we keep changing and taking the parts off, and bringing them over to the foundry tool room, and bringing back the parts that were all gone over, and bringing them back to the foundry and putting them on the machines.

The Master: I think Mr. Pillinger testified that you established the system there of having one machine

down for a general overhaul at one time, and when that was overhauled, replacing that, or installing that for production again, and taking down—

A. (Interrupting): Another one.

The Master (Continuing): —the next most worn machine.

A. Usually that one that has given the most trouble, and take it down and give it an overhauling.

The Master: He also testified, I believe, the overhaul job took about three weeks. Would that be in accordance with your recollection?

A. You mean on the Walcott lathe?

The Master: Oh, yes.

A. Oh, no.

The Master: How long would it take?

(1027) A. Well, of course, are you figuring on the time the men out in the shop and the men in the tool room, the whole business?

The Master: Yes. When you took one of the machines out for overhauling, how long would it be before you got that machine back?

A. We never took a whole machine out. We took the parts out and brought them into the shop for overhauling, and when they were fixed we carried those parts from that machine and assembled them to the machine. There never was a whole machine, a Walcott, that was carried out of the building into the foundry; only the parts that went into the machine.

The Master: Did you have a different type of overhauling system with the Walcott lathes than with the cam shapers?

A. Well, of course, it was this way, there was never any Walcott lathes transferred from the motor building to the foundry tool room.

The Master: There never was any general overhauling, then, or entire overhauling on any one Walcott lathe at any one time?

A. Outside of what was done in the production department. We tear them all down there. But, we never took the machine out; we never brought that over there. We take the over-head shaft, and the cams that are on it.

We took the slides out, replaced the spring that went underneath the machine that carried your slide back and forth, and we took the cam on the side of the machine and replaced any of the worn parts and had them brought in and had them gone in the shop and brought **(1028)** back and put them on the machines right there in the shop.

Mr. Farley (Continuing): Did you have a different system with respect to the Walcott machine than you had with the shapers? I mean, how was it you didn't take the Walcott machines out one at a time and completely overhaul them like you did the shapers? Was there any particular reason for any—

A. (Interrupting): Well, I tell you, on that they never did carry one of them machines out of the production department over into the foundry tool room because the biggest part of their trouble was all in those slides that was chiefly overcome. We could take care of that mostly right there. Of course, when head stock and tail stock and spindles, and that, had to be replaced, we pulled the two heads off, put them on the truck, take them over to the tool room, replace them with new bushings and sleeves, spindles, you know, and re-assemble them back, and when they were in condition, the heads went back, and put them on the table.

Q. Apparently you make a distinction between what you did with the shapers, where you sent them to the foundry tool room for overhaul? A. Shapers never went to the foundry tool room for overhaul on them. They were never carried out of the Highland Park plant. They lifted them right up and took them into the main tool room, and we gave them a general overhauling from top to bottom—the shapers did—but, on the Walcott lathes the bed of the machine never was moved out of the motor building.

Q. I see. A. Only the parts that were on the bed; that is, the spindle **(1029)** heads and steady rests and the overhead cams and overhead shafts, and the minor details that went onto the bed.

Q. Mr. Pillinger testified in order to keep up production he adopted the system there of having, on each day, having one machine down to replace the slides. Do you have any recollection of that? Is that in accordance with your recollection? A. Well, that was a system to change the slides and keep them cleaned up as much as possible, and in that way they were gone over, unless something had happened while they were changing that one, some other machine probably went down, then they would have to jump on that and fix that. Sometimes they would have two or three down there at one time.

Q. There would be times when— A. (Interrupting): Yes, sometimes two or three.

Q. Two or three down at one time for necessary repairs, or you might call them emergency repairs? A. You might be fixing one, and when you were doing that something happened on one of the other 14 machines; while you are doing something on one something happens to the other, and you may have two, three or four, maybe, at a time.

Q. In addition to this replacing the slides, Pillinger also said you made it a practice to keep one machine down for overhaul. Do you have any recollection of that, and do you distinguish between an overhaul where you left the bed of the machine right in position, and the type of overhaul—would that be the same overhaul, generally? A. Of course, they wouldn't pull everything off. It would be a minor job, you know. Where they take everything off and give **(1030)** it a general going over, it would be different. They just—

Q. (Interposing): Did you at regular intervals get around, make the circuit of those machines, and give it a complete inspection, replacing the parts that might be necessary? Did you do anything of that kind in addition to taking care of the emergency repairs? A. Oh, yes. We went right straight around from one to the other, until we got right around.

Q. Was that something like or at all similar to the same sort of thing you did with the shapers? A. Yes. Outside, of course, we did not move the bed of the machine. But, on the other hand, with the shapers, we did; we moved the whole thing bodily right out of there.

Q. I see. Do you know anything at all about the various other operations in the department in addition to the turning of the cams on the shapers—or, rather, the turning of the cam shafts on the Walcott machines and the machining of them on the shapers? Are you familiar with other operations in the Department 410? A. Of course, not to a great extent I wasn't. Of course, they had minor little troubles for fixtures for drilling of a pinhole here that went to the collar of the driver. I take care of those fixtures and line them up for them.

Q. Do you know anything about the straightening operations of that department? A. I know they centered them. First they center them, and then the next operation they had to straighten them in order to get them—in order to turn the cams.

(1031) Q. Do you know whether or not before the cam shafts went to the shapers there was any other straightening operation in addition to the one you just described? A. Oh, there was a straightening operation while they were shaped, and after they hardened them they went through a spinner that we used to have there, and then they straightened them, before they went to the grinder.

Q. Was there any difference with respect to the straightening operations between the machining of the shafts on the shapers and the machining of the shafts on the Walcott machines? A. Well, on the Walcott machines, I don't know, they seemed to have a tendency more so to spring than they did on the shapers, and you had to watch that a whole lot closer in order that when they went to the grinder they were straight enough so that they could clean up. Otherwise, they would have too many scraps on them.

Q. The question was, was there any difference, if you know, between the use of these two machines with respect to the straightening operations that were used before the machines went—before the shafts went to either the shaper or Walcott machines? A. I know they had to keep them closer—straighten them on the Walcott lathes—than they did on the shaper.

The Master: Did you say it was your recollection with the shaper there was a straightening operation after the rough turning and before the grinding of the cams?

A. After they came from the hardening furnace.

The Master: After they had been hardened?

A. Yes.

Mr. Farley: I think that is all. You may cross examine.

(1032) Cross Examination by Mr. Spohn.

Q. Mr. Schmidt, I understood your testimony to be that when you moved over to the Rouge plant from the Highland Park plant you took all these Walcott machines over to the Rouge plant. That is right, isn't it? A. Yes, sir, they shipped them all over there.

Q. And, in the meantime you set the shapers up in the Highland Park plant? A. Just to keep the production up.

Q. Just to keep the production up, and those shapers run for a couple of months over there before you got the Walcott set up in the Rouge plant? A. The shapers were put up again at the Highland Park plant.

Q. Yes, and they were run in the Highland Park plant for a couple of months? A. But, they shipped two shapers down to the Rouge plant in case they should happen to have to fall back on them. There were 2 shipped down there.

Q. But, the rest of them that were left in the Highland Park plant, they were kept in operation until you got the production you wanted— A. (Interrupting): Yes, sir.

Q. (Continuing): —on the Walcott machines? A. Yes, sir. They were kept at Highland Park.

Q. And about how long was that? Two or three months, you said, that those shapers operated at the Highland Park plant after the Walcotts had been taken over to the Rouge plant, yes. A. Just about, yes.

* * * * *

(1034) RUDY EHRHARD HERKLOTZ was thereupon called as a witness, and being first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. Are you the same Mr. Herklotz who testified in the proceedings before Judge Tuttle? A. Yes, sir.

Q. You are employed by the Ford Motor Company, Mr. Herklotz? A. Yes, sir.

Q. How long have you been employed by the company? A. 25 years.

Q. 25? A. Yes.

Mr. Spohn: 25?

A. 25, yes.

Q. What is the nature of your duties at the Ford Company? A. I started out as a die maker and later on I had charge—went to pattern work for a while, and then I had charge of ordering machinery.

Q. What department are you now in at the Ford Company? A. The engineering department.

(1035) Q. Engineering purchasing? A. Engineering purchasing.

Q. Under Mr. Kellogg? A. Yes, sir.

* * * * *

(1055) Q. Now, I show you a number of sheets, permanent inventory of machine tools, which have been marked Exhibits 246-A to R, and will ask you what type machines those permanent inventory **(1056)** cards refer to? A. The sheets refer to a machine for shaping the cam shaft, or a cam shaper; it will shape all eight cams at one time.

Q. These are regular records of your department? A. Yes, sir, they are the permanent inventory records.

Q. And they contain the same type of information as the Exhibits Y-1 to 24, that we were just talking about? A. Exactly the same.

Q. And will show just exactly what happened to the machine and when it was received? A. Yes, sir.

Q. And where it was located and all that sort of thing? A. Yes

Mr. Farley: I offer those permanent inventory cards in evidence as Exhibits 246-A to R, inclusive. I assume there is no objection.

Mr. Spohn: No objection.

The Master: They may be admitted.

Q. Now, I think, to save time, and it will be convenient here, have you prepared a list showing the date of acquisition of these particular machines and the date when they were salvaged, from these records? A. Yes, from these records, Ford cam shapers.

Q. Can you by reference to the list state briefly what the facts were concerning the dates, when you got those machines, and the dates when they were salvaged? A. You want me to read them off, each one of them?

Q. I think we can save time that way? **(1057)** A. Two were received in 1915, three in 1916, seven in 1917, two in 1919, one in 1923, and four in 1924.

Q. So far as the disposition of the machines now, can you state when the history shows that? A. 11 were salvaged in March '25.

Q. March or January? A. January, '25.

Mr. Spohn: January, 1925.

A. Yes.

Q. What does the record show as to the first machine? A. The first machine?

Q. Acquired 10-28-15, when was that one salvaged? A. That was salvaged December 1st, 1922.

Q. Now, then, how many machines all told are covered by— A. By the salvage?

Q. No, by the entire list, how many cam shapers did you have? A. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18; but here the last four I think will show right on this list here, they were never put into production. Here we have a note on there, that they were cancelled by Mr. Wibel's department at that time. There was only 13 on production.

The Master: Just a minute. You have not completed your statement as to the salvage?

A. 6 shapers were salvaged.

The Master: On different dates in '26?

A. In '26, in August, '26.

The Master: I noticed that you said these machines, or those machines that were salvaged in '25,

were on January, '25. **(1058)** Some of them were on March 16, 1925, just to correct the record on that.

A. Yes. Shall I read them off?

Q. No. What does the record show concerning the last date when any of those shapers was available? A. The last shaper—this will show here on these shapers here, the last four of them never were in operation, there were only 13 in operation. This was here in '25.

Q. That is January 1, 1925? A. Yes.

The Master: The last four or the last five were never in operation?

A. The last five. 13 were in production.

The Master: These 13 did not include this first machine which was salvaged in '22?

A. No. There is another one down here. That makes that 13. There was one salvaged here. That makes the 13 shapers.

Mr. Spohn: What was the answer to that question?

Mr. Farley: He says that makes it 13 shapers.

The Master: 13 shapers in operation as to what time?

A. That would be from this time to here.

Mr. Spohn: Was it four or five shapers that were never put into production or were available in 1925?

The Master: That was my question, and I think your answer was there were four shapers that were never put into operation, was it not?

A. Yes.

The Master: And when you said there were 13 in production, **(1059)** you were excluding, in addition to these four, the first machine which was salvaged in '22?

Mr. Spohn: That ties up. It was four, then, that were never used?

* * * * *

(1063) The Master: Referring to these last four machines which were acquired in 1924, I am not quite

clear why these are shown to have been salvaged in 1925 and 1926. Does that mean that the order was cancelled on that?

A. Yes, the order was cancelled, but the machine had been partly finished; some of them may have been almost finished.

The Master: Were the unfinished machines delivered to the Ford plant?

A. I don't know. I think there was a work order made out on that. **(1064)** They were made on a Ford work order. They were made at the plant. They must have been half or three-quarters or partly finished, when the order was cancelled, and a brass tag assigned to it already. Let me see that 34,312? What does it say on that. 9-26-24.

Mr. Spohn: If the Court please, was that last question of yours answered? I did not quite get it. I think there was some confusion. I think Exhibit O will clear it up, if your Honor will refer to it. Mr. Farley, I think this will clear it all up. Exhibit O. This is a letter of the Ford Motor Company to the Jackson shapers:

"Confirming our telephone conversation of the 11th, you may use this as authority to proceed with five special machines for shaping cams and so forth."

This is dated December 12, 1932.

"As explained to you, we are building in our tool room four of these machines in addition to this order for five."

Mr. Farley: Oh, yes.

Q. Then these last four machines that are listed, apparently—it says so quite clearly on the permanent inventory, each of them says manufactured by the Ford Motor Company, that is correct, is it not? A. Yes, sir.

Q. So, then, those machines covered by these Exhibits 246-O, P, Q, and R, have no relation to the cancellation of the order noted on the Exhibit 248? A. You mean this note on here?

The Master: There might be a cancellation of a departmental order.

(1065) Mr. Farley: It says special tool and fixtures. It says five.

A. That is when it was ordered, when Wibel ordered these machines to be made, and then his department, the tool design, issued the order 11-26-23 to build those four machines. I don't know who made these here, if those were actually built at the Ford Motor Company or if they were built on the outside. It looks to me as if they were built on the outside, because it says here order. It must have been outside, because there is the order D-48697 issued 1-18-24.

Q. And then there is a note under here? A. Four special Ford cam shapers, communication to Emde.

The Master: So the list that you have here, Exhibit 247, refers not only to shapers that were actually in the plant and used on production, but the additional five shapers which were being ordered outside and the four shapers which were being made in the shop, and for these last four, you have the brass tag numbers, but no brass tags for the other five?

A. For the ones made at the Ford Motor, yes.

* * * * *

(1068) Q. You used these milling machines covered by the permanent inventories 249-A to 249-G for the production of the Model A camshafts, did you not? A. Yes, sir.

Q. Could you use those machines for the production of the V-8 camshafts? A. No.

Q. What did you do when you started the V-8 production, what kind of machine did you use? A. Well, a machine similar in principle that we used for the Model A, what we called the Pioch machine.

Q. You used these machines that were first referred to, when covered by these permanent inventory cards, as the Pioch machines? A. Yes.

Q. And all through these proceedings? A. Yes.

Q. That is how they were known in the plant? A. Yes.

Q. You could not use those machines on the V-8 shafts?
(1069) A. No.

Q. Did you use the Pioch machines on the V-8 shafts?
A. Yes.

Q. Then what did you use when you got to the V-8 production? A. Those machines that were used on the Model A, they were salvaged, and the new Pioch machine was built around the V-8 camshaft. At that time it was known as the 18.

Q. How many machines did you use on Model 18 camshaft, Pioch machines? A. On 18 we used ten machines in sets of five. There was required two machines to complete the operation, but they were designed around the same principle as the Model A.

Mr. Farley: I might state at this time for the record that we did not produce the permanent inventory cards for the V-8 Pioch machines, but this list was prepared from the inventory cards, and we can readily produce those, if counsel would like to have them to check them, or for any other purpose.

Q. That is, ten additional Pioch machines were built for the V-8 job, and the Pioch machines that had been used on the Model A, which could not be used for the V-8 shaft because of the difference in the shaft, were salvaged?

Mr. Michael: When was the first new machine purchased?

Q. Will you refer to that? A. On the Model A?

Q. No, the Model V-8? A. The first machine was in May 24, 1932.

The Master: May 24, 1932?

A. Here is another one earlier. May 4, 1932, the first machine. **(1070)** Those two machines go together, to complete the shaft, two machines to one set.

Q. When you changed from the Model T to the Model A production, were any of the camshaft shapers available? The date of the change from the Model T to the Model A, that was in December, 1927, is that according to your recollection? A. No, there were no more shapers available. They were already salvaged.

Q. Could you have used shapers if they had been available, the Model T shapers, if they had been available, for the Model A shafts? A. No.

Q. Suppose you had wanted to use shapers for the Model A shafts, what would you have done?

Mr. Spohn: Just a minute. I think the witness answered the question.

The Master: He said you could not use them for the Model A and now you ask, suppose you wanted to use them.

Mr. Farley: Not the same shaper. I said suppose you wanted to use shapers.

(The question was read.)

The Master: You are amplifying your question so that it does not refer to the particular shapers used on the Model T.

Mr. Farley: Yes.

Mr. Spohn: The question now is shapers other than the shapers heretofore used on the Model T.

(1071) Q. Let me put this question: What did you do in the Ford Motor Company, Mr. Herklotz, when you changed from one model to another, and I am going to refer you now to just what you did do when you changed from the Model A production to the V-8 production, and referring particularly to the Pioch machines, I asked you a while ago did you use the Pioch machines that you had used on the Model A for the V-8? A. No.

Q. Then what kind of machines did you use on the V-8? A. We also used the Pioch machine on the V-8, but that machine was designed or re-built to machine the Model 18 camshaft.

Q. In other words, when you changed from the Model A to the V-8 production—in the first place when you designed the Pioch machine for the Model A production, that machine was intact, designed around the shaft, wasn't it? A. Yes.

Q. To build that particular shaft? A. Yes.

Q. As far as the Model T shapers were concerned, were they also designed around the Model T shaft?

Mr. Spohn: Just a moment, I think that is leading the witness pretty far along there on testimony of this type.

The Master: This is a very important branch of the game. I think you ought to be as careful as possible not to lead the witness at this point. Read the last question.

(The question was read.)

Mr. Spohn: That is going too far. I object to the question.

(1072) Mr. Farley: All right. You can strike the question.

Q. Will you state, if you know, whether the practice in designing the Model T shapers was any different from that in designing the Pioch machines for the Model A shaft?

Mr. Spohn: If you know of your own knowledge, now. May I have a preliminary question on this?

The Master: Go ahead.

Mr. Spohn: Were you with the Ford Motor Company when the shaper machines were designed?

A. I was with the Ford Motor Company, but not in the capacity I am now.

Mr. Spohn: What capacity were you then in?

A. I worked as a tool maker, then.

Mr. Spohn: Did you know when the camshapers were designed, what year?

A. I know they were designed in 1915.

Mr. Spohn: Are you sure of that?

A. Yes.

Mr. Spohn: Is it not a fact that they were designed about '12 or '13?

A. Well, I would not know the year exactly. It was about that time.

Mr. Spohn: I object to the question, no proper background, knowledge or information on behalf of the witness.

A. The records show the date.

Q. Are you familiar with the shapers? A. No.

Q. That is, have you ever seen the shapers? **(1073)**

A. Yes, I know exactly what the shapers will do and

what they were designed for, I know exactly what they do.

Q. And what were they designed for? A. Designed for the Model T camshaft.

Q. Could they be used for any other purpose? A. They can be used if they are re-designed.

Q. Now, you testified before Judge Tuttle and you were asked certain questions, and I am going to read that testimony to you. I am reading, beginning at the bottom of page 565 of the original transcript, and this question was asked you:

> "Q. Now, did you know enough about the cam shapers that were used for the Model T camshafts to know whether those could be used for machining instead of rough grinding the cams on the tractor camshafts like Exhibit 35?"

And you answer:

> "A. The cam shapers could not have been used in the tractor camshafts for machining the cams, rough machining."

Do you want to change that answer, or is that— A. The shaper could not have been used on the Model F, that is, the tractor camshaft.

Q. And you were asked the question: "Why," and you said:

> "Because, on account of the design; on the Model T, the bearings are about the same size as the cams; on the tractor camshafts, they are not. You have an interference here; in fact, interference on the three bearings."

The next question was:

> "Q. On the center bearing of the tractor camshaft, as well as the end bearings, you say there would be an **(1074)** interference?"

Your answer was: "Yes, sir."

Next question:

> "Q. That was because the bearings on the tractor camshaft were very much larger than the diameter of the shaft itself? A. Yes, sir.

"Q. And as shown by Exhibit 34, the end and middle bearings were not much different in diameter from the rest of the shaft?"

And you were referring to this exhibit Model T camshaft when you were testifying there, is that correct? A. Yes, sir.

Q. And your answer to that question:

"Q. As shown by Exhibit 34,"

Your answer was:

"A. Yes, sir."

And the next question:

"Q. Now, explain to the Court why that difference in shaft design would make it impossible, as you have said it was, to use the shapers?"

And your answer was:

"A. On the shaper, the tool was used with the cutting point representing like the pencil here (illustrating), and was about, I will say, about one inch wide."

Probably you could illustrate that as I read it to the Court.

"The width for that. Still we could re-grind these tools, keep on grinding them back, and that was back where **(1075)** it had no room to get down here at all. Besides, you know, even if there was, even if we had used a very narrow tool, it was impossible, because the stroke was necessary to go across here, in order to start on the front of the cam as we had to go back as far as this."

You understand that, or do you want the witness to explain that further?

The Master: I think I understand it.

Q. "Q. And go back on the main bearing? A. The main bearing.

"Q. And that would have cut the main bearing, and that is the reason you could not use those camshaft shapers in place of the rough grinders on the tractor shaft? A. Yes, sir.

The Court: And therefore, you did use what?

A. We used a rough grinder."

The next question:

"Q. What kind of camshaft was used on the Model A?"

Mr. Spohn: Now, where are you reading from?

Mr. Farley: This is Mr. Herklotz' testimony from page 592 of the transcript, as you quoted it to him there.

"Q. What kind of camshaft was used on the Model A? A. What kind of camshaft?

"Q. Yes. A. This is the camshaft for the Model A (indicating).

"Q. Exhibit 29."

And you were then referring to the exhibit which you now have in your hand, Exhibit 29. The question is:

(1076) "Q. 29. Now, was this possible to take that off the shaper? A. No."

Then Mr. Spohn read further. Referring now to page 611:

"Q. Why couldn't you turn or cut the Model A cam shaft on the shapers that had been used on the Model T shaft? A. There is the Model A and that is just about the same design as the tractor cam shaft, and for the same reason, on account of interference of these bearings. Now, the tool would have to go back here, and it had to come back here (indicating), and it just would simply take this part of the bearing off.

"Q. Abut against the enlarged bearings on the end of the cam shaft? A. Yes.

"Q. And that was the only reason why the shaper for the Model T cam shaft like Exhibit 34 would not operate on the Model A cam shaft or on the tractor cam shaft?"

And your answer was:

"A. Yes, sir."

A. Yes, sir.

Q. Now, after hearing all of that testimony that I read to you, is there any change or correction you would like to make in any of it? A. Yes.

Q. Now, just a minute.

Mr. Spohn: Now, if your Honor please, the witness has said yes.

The Master: I have not heard the next question yet so **(1077)** there cannot be any objection until it is asked, at least.

Q. Are there any of those answers which you gave at that time which you would change in any respect right now? A. No, they were correct.

Q. What is the nature of your— A. Would you let me say something in regard to that answer? I was asked then—

Mr. Spohn: Just a moment. I reserve the right to move to strike this.

The Master: All right. I will hear what he wants to say, and then I will entertain your motion.

A. I was asked if the shaper on the Model T cam shaft could be used as well as on the Model A. I said no. That is all I was asked. I was not asked if that shaper could be re-built in making this Model A cam shaft, and which can be very readily done.

Mr. Spohn: Just a minute, now. We have no objection to that answer.

The Master: Suppose you had small size bearings on the Model A like you did on the Model T, but there was simply a difference in the size of the cams and the size of the shaft, so that the shaft was—or the relative sizes between the bearings and the cam was the same in the Model A and the Model T, except both were larger than the Model A, and you had been asked the same question, whether the Model T shaper could have been used in turning the Model A cams, what would you have said?

A. If these bearings had been the same diameter as this one here, if the shaper could have been used?

The Master: If the bearings would have been a larger diameter **(1078)** and the cams a larger diameter than on the Model T but the same relative size?

A. Then the shaper could have been used.

The Master: You would have had to make some re-design of the tools?

A. Just to raise them up. If the relation between the cam and the bearing was the same, in principle, the shaper could have been used with some alterations, some slight alterations by just raising the tool up higher.

Q. Suppose, Mr. Herklotz, you had made a change in the Model T production, and, without changing the shaft in any other manner, had changed the spacing of the bearings,—let us say, consider that we shortened the shaft up about 6 or 8 inches, could you have used the Model T shapers if you had them, on the shaft so changed? A. If the bearings had not been changed in relation to the cams, we could have used the shaper, as long as there was no interference in between, so that we could get the tool in between the spaces of the cam.

Q. Well, suppose you changed the size of your cam shaft to such an extent that, with your shaper tools as you had them, and the spacing of the shaper tools, so they would not fit the spacing of the cam, could you have used the shaper? A. We would have had to build a different shaper around that particular cam shaft.

Q. Is that a practice that is followed at all, to your knowledge, in the Ford Company, building machines and changing machines as you change from one model to another, and building a machine around the part to be produced—is that anything unusual? **(1079)** A. No, nothing unusual at all. We do that every day. In fact, I might say we will specify or order or re-design or build probably two or three machines of that nature a day.

Q. When you changed over from the Model T to the Model A production, do you have any idea how many new machines you had to rebuild because of that change? A. Well, without really thinking it over—

Mr. Spohn: I object to the question as incompetent, irrelevant and immaterial. We are not here on the V-8 production.

Mr. Farley: I am not talking about the V-8. I am talking about the Model T and the Model A.

Mr. Spohn: What was the question?

(The question was read.)

Mr. Spohn: Withdraw the objection.

A. I would say in the neighborhood of a thousand machines.

Q. Most of those machines purchased, as far as any new machines were concerned, that all went through your hands? A. Yes, with the exception of the 18 Z machines, which usually come through the mechanical design.

Q. You had personally a considerable amount of experience with the Gordon machine that was attempted to be used in the Ford plant, did you not? A. Yes, sir.

Q. And did you find that machine worked satisfactorily? A. Well—

Q. The Gordon machine? A. Well, we tried very hard to make it work. I think we had it in the plant for about three months. We could not make it work, and it was decided to send it back and have it gone over, and **(1080)** it was returned about four months later, and it was still the same, we could not make the machine work. It probably took a week to tune up the machine, and we could probably run it for one hour on production, and then it was down again. I would say if the machine would have done the work or had a possible chance of doing the work, we possibly would have bought all Gordon machines.

Q. In other words, if the Gordon machine had been a satisfactory machine for your purpose, you would have ordered all Gordon machines? A. Yes, sir.

Q. Now, did you have anything to do with the operation of the first Walcott machine that was brought into the plant? A. Yes.

Q. That was bought for the tractor production? A. Yes, sir.

Q. How did that machine operate on the tractor production? A. Well, the machine showed a much improved way of performing.

The Master: Improvement over what?

A. Over the Gordon, over the Gordon cam shaft lathe.

The Master: Did you try to use the Gordon machine on the tractor production?

A. Yes. It was bought for the tractor, the first Gordon machine was bought for the tractor production.

Q. Now, about what was the production you got with the Walcott machines on the tractor cam shaft, pieces per hour, as you recall? A. Around 25.

(1081) Mr. Farley: We were required by the Court here to file answers to certain questions, and we were asked to state what methods and means had been employed by the Ford Company just immediately prior to the acquisition of the Walcott machines, before we bought the Walcott machines, and we answered that by saying that we attempted or we used—well, I will read the answer that I prepared after talking with you about this matter.

"The method and means employed by defendant immediately prior to the adoption and use of the infringing machines for reducing to finished size the rough forged cams of tractor cam shafts were:

"First, a roughing finish performed by (a) a Gordon lathe as disclosed in Plaintiff's Exhibit 2, patent number 1,542,803 to Charles Gordon and Alfred W. Redlin, and (b) a rough grinding operation in which the excess material was removed by means of a Landis 10-X-36 grinder."

Q. Now, you recall the Gordon lathe, and I will ask you to look at the views of the Gordon patent, number 1,542,803, which is an exhibit here. Plaintiff's Exhibit 2? A. You ask what we used prior?

Q. I want first to ask you: Do the drawings of this patent correctly represent the Gordon machine and as you remember the machine that was in the Ford plant? A. Yes, I remember the machine just as it is represented here, the way it was in the Ford plant.

Mr. Farley: I won't go over all this statement of the operation of the machine which is reproduced in our paragraph 36 **(1082)** of our statement of account, because I think most of that Mr. Gordon admitted. I will read this part, however:

"The mode of operation of the Gordon machine was to oscillate the tool about its cutting point as a center for the purpose of maintaining the side cutting edge of the tool substantially normal to that portion of the work with which the point of the tool at any instance came in contact."

Q. That is the way that machine worked? A. Yes.

"Due to the swinging of the tool upon its point, it was necessary that the cam 44 be designed to swing the tool holder 34 through an angle of approximately 80 degrees while the work was turning through an angular rotation of 6 degrees."

Is that correct? A. Yes, sir.

Q. "Because of the impossibility of effecting a movement of approximately 80 degrees on the work holder 34 during but 6 degrees of movement of the work shaft, it was impossible to control the movement of the cutting tool and to keep the roller 53 in contact with the cam 44 as the tool was passing around the nose of the cam shaft, the roller dropping through space without touching the master cams, while the tool was going around the high point or nose of the cam."

First, will you state whether that is a correct statement of what happened in the operation of that machine at the Ford Company?

* * * * *

(1083) Q. Can you illustrate just what you had in mind when you testified to that effect before Judge Tuttle with this particular model, particularly with respect to the impossibility of effecting a movement of the tool around the nose of the cam and about the roller dropping through space.

The Master: Before you do that, I am not just quite clear what you personally had to do with the Gordon machine when it was on trial in the Ford plant?

A. What I had to do with the machines?

The Master: Was it on demonstration?

A. Yes, I had charge of all special machines. I was instrumental in recommending the Gordon machine for turning cams on the cam shaft.

The Master: And while it was there you observed its operation?

A. Watched its operation, and tried to make the machine do what it was supposed to do.

Q. I might bring out, witness, the fact that that was a regular part of your duty, when you ordered a special ma-

chine, particularly **(1084)** if it is a machine of a type you have not purchased before, do you make it a practice to go into the shop and observe the machine in operation and see whether it is doing the job or not? A. Yes, and if it does not, we work together with the manufacturer and we furnish men, mechanical, to improve or make changes, in order for the machine to stand up on production. In this particular case, I remember very distinctly these springs—

The Master: Spring 59.

A. This spring here, 59, because it had to travel so far—the spring was quite short, but it had to compress almost solid, and it kept on breaking continuously, and as soon as the spring broke, the tool would not follow the cam no more, and it just broke the tool. Another case was that this cam here, there were eight cams—

The Master: You are referring to the master cam marked 42?

A. Marked 44. They were just being marked with one key way. The cam was quite narrow, the key way, these cams have to be very close in relation to the position of these cams on the cam shaft. First of all, they had that key way about in there (indicating). Then, instead of having the cam where it could really be, the cam should be here, in here the cam was over here (indicating); and we were taking off on this side sometimes 3/16ths to 1/4 of an inch, and over on this side we would be missing by a sixteenth of an inch. We did not have enough stock over here (indicating). That was the principal trouble with the machine, the wearing out of these key ways, **(1085)** getting the location of the position of the cam, and breaking this spring. We just simply could not keep it up.

Mr. Farley: Now, I think, in order to save time on this, if your Honor please, I will ask the witness during the recess, and it is getting close to recess time now, I will have him read this, the answer to this account, and then I will ask him when he comes back on the stand to state whether or not he would like to make any corrections to the tabulations and so forth that I prepared. I had to rely upon his testimony and conferences had with him, because I used his experience with the machine in preparing these particular answers.

Mr. Spohn: Does that mean that the witness is going to read, during the recess, answer 36.

Mr. Farley: I am referring to all questions directed to us. I think they run from—

Mr. Spohn: Which numbers?

Mr. Farley: 35 on to 44, inclusive.

Q. One or two more questions. Were you familiar with the operation of the Walcott machines on the Model T job? A. Yes, sir.

Q. What, if any, was the experience or difference in experience between your use of the Walcott machines on the Fordson shafts as compared with the Model T shafts? A. Well, on the cam shaft—the Melling or Walcott cam turning lathe they showed very much improved design on the possibility for production, but I would say, only, that machine could be used on small production. On account of the nature of all these mechanical and moving tools, it really was not a machine **(1086)** for big production. I would say for maybe 500 a day the machine was okay, but for real heavy production, that machine is really a failure, for big production.

Q. The machine worked fairly satisfactorily for the tractor? A. For small production.

Q. What was the tractor production? A. From 400 to 500 a day.

Q. What was the Model T production? A. The Model T production in those days was 8,000 to 8,500 a day.

Q. Were you in a position to know whether or not the use of the Walcott machines proved to be more costly than the machining of the shafts on the shaper?

Mr. Spohn: Now, at what time?

Q. At any time?

Mr. Spohn: Just answer that question yes or no.

(The question was read.)

Q. I will make it read: More costly or less costly.

Mr. Spohn: At any time.

The Master: Are you in a position to so know?

A. It was more costly.

Mr. Spohn: I move the question and answer be stricken.

Q. Wait a minute. You have to answer first whether you are in a position to know whether it is more costly? A. Yes, I am.

The Master: And you state now it was more costly?

A. Yes.

Q. Do you know why it turned out to be more costly? A. Because the machine was built, as I said before, really for small production, and in order to push it for heavy production, **(1087)** everything had to be built out of tool steel, and with all the sliding movements, so many joints and movements, the machine simply would not stand up.

Q. Now, you used those machines for the period from 1925 until 1931, about six years? A. Yes.

Q. Why did you use the machines so long if they would not stand up? A. Well, it took a long time to find out and just see if we could improve the machines. The machines came in there with machine steel and cast iron slides, and we tried to improve the machine by making the slides out of machine steel, carbonized and hardened. Then we made them out of high speed steel. And then we had salvaged the shapers already, and we really were obliged to use the cam lathes for production, and keep up the expensive repairs on those machines.

The Master: Then in 1929 you got around to considering the purchase of more machines to do the job, and you did not turn back to the shaper, but you bought more Walcott machines?

A. No, because we turned-rough and semi-turned the cams; in order to get less stock for the grinder, we had to buy six more additional machines in order to take the third cut, to get the camshaft down to size.

Q. When you bought the machines in 1929, you had not scrapped any of the original Walcott machines you had? A. No.

Q. Whereas, if you had gone to the shaper, what would you have had to have done in 1929? A. If we had gone to the shaper in machining those of the Model A?

(1088) Q. Yes. In 1929 at the time you bought the six additional Walcott machines—do you follow that? A. Yes.

Q. Now, suppose at that time when you were on the Model A production you had wanted to go to shapers? A. Yes.

Q. What would you have had to do? A. Well, we had to re-design, re-build the shapers to take care of the Model A shaft.

Q. Then, what would you have had to do with the Walcott machines which you had? How many Walcott machines did you have at that time? A. We had 13—no, 16 we had, 16 Walcotts.

Q. And you bought— A. —six more.

Q. Six additional? A. Yes.

Q. Were you getting out your production at that time with the 16 Walcott machines? A. We were getting out production on the Walcotts all right, but we could not get production out of the grinders, because we would leave too much stock on the cams. That is why we bought the six additional Walcotts, to reduce the stock, so we could get the production out of the cam grinders.

Q. Do you have any recollection of what the Model A production was in 1929,—was it a very high production? A. 1929, I think we made around six thousand or a little better.

Q. A day? **(1089)** A. Yes, sir.

The Master: Well, why could not you have bought in 1929, say, six shapers and used them side by side with the 16 Melling machines, if you had not had such a load on the Melling machines, so they would have done the job better and taken off more stock—wouldn't they?

A. Well, from what I know now, from the Walcott lathe, that is what we should have done; we should have gone back to the shapers.

The Master: Were these Melling machines that were purchased in 1924 pretty well worn out by 1929?

A. Oh, yes. In fact, we had to re-build them all before they really would stand up on production.

The Master: Is that the reason they would not take off enough stock because of their worn character?

A. Yes, it is the nature of the design, the machine had so many joints.

Q. (By the Master): Did you put new machines in service at that time, with these new machines, for example, would they take off enough stock without using a third rough cutting operation? In other words, what I am getting at, was the reason that the machines in 1929 would not take off sufficient stock, and the reason why you had to purchase six additional machines for a third rough cut operation, was it because of the fact that the machines which were purchased in 1924 were so badly worn by 1929, or was it because of inherent difficulty in the machine itself? A. No, it was just the design of the nature of the machine, the springy design of the machine, it would not take a sufficient **(1090)** amount of stock off.

Q. Do you mean by that it would not take sufficient stock off all around the cam, or that it would leave stock at points in the cam? A. It was too springy. All these different joints, they kept multiplying it. I will explain it a little more. When we would start with a cut on the machine, we started here. Now, before the tool really came down to this size, it used to come up, I might say, a hill, and all the play was taken out of the machine, through the tension of the cut on the front, when it finally came down to this size. So when we started out, we started out about a thirty-second smaller in diameter, until the pressure or the backlash of the different joints in the machine was taken up, and the tool started to cut its regular size, and which caused that we always had really to start with a tool so much smaller in diameter, so it would remove this stock that it should remove according to the gauges. When it came up here with the tool, this tool here in going across here, the tool really had to start a little lower first, and gradually you were building up tension and tension, and then it finally went across, because there was so much backlash in the different joints before we got to the tool.

The Master: What you are really saying, in answer to Mr. Farley's question, is that there was excess stock left all the way around the cam, and not just at particular places, is that right?

A. All the way around the cam, the shape of the cam.

Q. Can you tell by looking at that particular shaft—have you **(1091)** looked at that tag? A. No, I have not.

Q. Can you tell by looking at that shaft, how the cams were machined, on what machine they were done? A. It looks like they were done either on the Melling or Westinghouse method, I don't know, I could not say from here. It looks to me—no, I could not say.

Q. Now, you spoke of having to overhaul the Walcott machines, and I will show you a bunch of papers, some of which have been marked, I don't know whether all—yes, they have been marked Exhibits P-1 to P-14. Can you state what they are? A. Yes. 619,276 was moved from the K motor building—

Q. Just a minute. First I want to know what they are. They are working orders of the Ford Company? A. Yes, working orders issued to do certain work on machines.

Q. I notice that this first one, which is marked P-1, has your name, "R. Herklotz"? A. Yes, sir.

Q. Is that a work order issued by you? A. Yes, sir.

Q. And there are a number of them all clipped together here in that particular exhibit. Without reading all of them there—first let me ask what particular machine does it refer to? A. You mean the brass tag Melling,—Melling cam 35472, overhaul for A-4260. That is the Model A camshaft.

Q. All of these slips that are clipped together here—is that the way you filed those in your department? A. These are general work orders. On these sub-orders, they are **(1092)** made out on what the fellows sign when they take the machine apart.

Q. The parts to be replaced and that sort of thing? A. Yes.

Q. How about this tabulation apparently done on some sort of adding machine? A. This has to be done by the accounting department, because they are getting a copy of the order.

Q. That is a tabulation made by the Ford Motor Company accounting department? A. Yes.

Q. That is intended to show the costs of all the work sheets in the clip? A. Yes, sir.

Q. Is that also true of each and every one? A. Yes, sir. This one refers to cam lathe 36592.

Mr. Farley: In view of the fact, I believe there was some objection to certain computations and costs prepared by Mr. Woehrle, and for which these are the basis, I offer these in evidence now as Exhibits P-1 to 14, inclusive, as records from Mr. Herklotz' department, having to do with overhauls of these particular machines?

Mr. Spohn: No objection.

The Master: They are all admitted.

* * * * *

(1093) Q. You were asked to read, Mr. Herklotz, during the recess, the text of the answers 36 to 43, inclusive, of Defendant's first statement of account, which is Exhibit A in these proceedings. Have you read over that? A. Yes, sir.

Q. I think you have already testified that you were familiar with the operation of the Gordon machine in the Ford Company's plant? A. Yes.

Q. And, now, do the statements as contained in those paragraphs which you read in this Exhibit A correctly recite the facts, as you know?

Mr. Spohn: Objected to as incompetent, irrelevant and immaterial, not within the issues.

The Master: I will overrule the objection.

Q. (By Mr. Farley, continuing): And, the answer is? A. They are correct.

* * * * *

(1096) Q. In your position you knew of some of these, and you have already testified about the difficulties you had with the Walcott machines on the Model T production, on the high production? A. Yes.

Q. Are you aware of the fact that the Ford Motor Company has a time study department, and that they send men out with stop watches to time the operations? **(1097)** A. Yes.

Q. You know about that? A. Yes.

Q. Now, which is the more accurate record, Mr. Herklotz, assuming that your time study men make a time study observation, clocking the man on the machine, which

will give the more accurate record of production, the records of the time study men of the time study sheets or the operation sheets such as this Exhibit 154-B, which you prepared in your department? A. The time study would show lots closer than the operation sheet, but the man on the time study, he only can watch the machine; suppose he watches the machines for one hour, he can't get an average. The machine runs 10 or 24 hours a day, and over that average we get lots less than what we will get, or get when a man stands right there and watches.

Q. Assuming you have a time study that was made in October of 1924, at which time these Walcott machines had been in use for some six months, and had turned pretty nearly a million shafts, would the time given at that particular time study be varied during the remainder of the operation on the Model T shafts? That is, would it, if there would be any variation, would you say that there was anything about the machines, as such, that would in the continued operation in the next three or four years, cause the machines to turn out more shafts per hour or less shafts per hour, or just what would the condition there be? A. Well, from my experience I can say that we were getting less than the time study shows for one reason, as the machines were getting older, and trying to keep them in repair, they got so out-of-joint, it was absolutely impossible to get the production **(1098)** we should be getting. That is the reason we had to buy six more machines to come anywhere near within the limits so that we could turn the right amount of shafts out on the cam grinders.

Q. I think when you bought the six additional machines, I recall the Master asked you the question why did you not, when you got those six additional machines, buy shapers? A. Well, we were on high production right then, you know, and when the shapers were destroyed and the old design could not have been used on the eight cams, they would have to be redesigned and rebuilt. We couldn't have changed. It probably would have taken us six months to get the machine on the job. Whereas, we took the standard machine—what we might call the Walcott standard machine —and we could get those in six to eight weeks. Another thing, the Mellings didn't turn out the work as they should. First, it was never thought of that those camshafts would

have to be straightened after they came off the cam lathe. On the shaper we didn't have to straighten them, and on these cam lathes we had to put in an operation of straightening.

Mr. Spohn: Will you read that answer, please?

(The last answer was thereupon read by the reporter.)

The Master: You didn't have any actual experience with the shaper to know whether or not you had to straighten it?

A. I didn't have any actual experience, but I know we did not straighten them.

* * * * *

(1101) Mr. Farley: As long as cross examination has not yet started, there is one other part of this statement of account to which I direct Mr. Herklotz's attention, which I neglected to question him concerning, and that is the various tabulations of cost contained in the Exhibit 11 as attached to our statement of account, Exhibit "A."

Q. (By Mr. Farley): Of course, you had nothing to do with the **(1102)** preparation of any of the tabulations or computations there (handing document to witness)? A. No.

Q. But, as far as the figures concerning rate of production, and as in sub-paragraph C, rate of production, 5 shafts per hour on the Gordon machine, what would you say as to that? A. Well, I think it is a very good average, 5 per hour.

Q. And, under the column entitled, "Burden II," under paragraph II, we have set up two tool repair men at $.90 an hour, $1.80. What have you to say about the correctness of that? A. That is the same. That is the two tool repair men on each shift.

Q. And, under paragraph D, cost of scrapping, due to defective work on Gordon machine operation, the Exhibit 11 stated, "It appears in using the Gordon machine 60 percent of all the shafts placed in the machine were defectively machined and had to be scrapped." In other words, the usable output was only about 40 percent. What would you

have to say about that? A. I think that is quite conservative. I do really think it is usually, what we could use, was less than 40 percent, because the shafts took off too much on one side, and they could not be salvaged.

Q. Are you familiar with the production per hour on Landis machines, Landis grinders on Fordson tractors? A. I do not remember.

Q. What would you say as to which would be the most costly way of machining the Fordson, F-446 shafts by means of a Landis grinder, or by means of a Gordon machine?

(1103) Mr. Spohn: Objected to. The witness said he doesn't remember production of Landis grinders.

The Master: I sustain the objection. That would require quite an elaborate—

Mr. Farley: (Interposing): Your Honor please, the witness knows something about cost. It may not be he can remember exactly the output per hour on Landis grinders, or Fordson tractors, but let me have a question or two.

Q. (By Mr. Farley): Is it part of your duties there, Mr. Herklotz, to know in a general way of comparative cost of various machining operations? A. Yes, sir; decidedly.

Q. Do you think you know enough about the cost of machining the tractor cam shafts on the Landis grinders to be able to make a comparison between that and the Gordon machine? A. Well, as long as we had the Gordon machine in the plant it required two mechanics to maintain the machine. With the grinders we didn't have any. After they had been running five or six years, I am sure we made the cams cheaper on the Landis grinders than we did on the Gordon machine.

Q. As a man in charge of recommending the purchase of new special purpose machines, would you have recommended the purchase of the Gordon machine as an improvement over the Landis grinders, for the tractor cam shafts? A. I would have recommended the Gordon machine if it had done the work the way it was specified in the proposal.

Q. But, after your experience with the machine would you have recommended it? A. No.

* * * * *

(1110) WILLIAM F. PIOCH was thereupon called as a witness on behalf of the Defendant herein, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. What is your name? A. William F. Pioch.

Q. Where do you live, Mr. Pioch? A. Detroit.

Q. You are employed by the Ford Motor Company? A. Yes, sir.

Q. How long have you been employed by the Ford Motor Company, Mr. Pioch? A. Since July 19, 1912.

Q. What is your present position at the Ford Company? A. Well, as a rule, we don't have titles out there, but I have charge of all the designing out there for production tools and machines.

Q. Approximately how many machine designers and draftsmen have you in your department? A. Right now we have about 135. We have had as high as 480, I think, is the highest figure.

Q. How long have you had that particular position you now occupy, Mr. Pioch? A. Since July, 1926.

(1111) Q. What were your duties before that, before July, 1926, when you were made head of this department? A. I was an assistant in the department.

Q. And, how long have you been in that department now all told? A. Well, I was made an assistant foreman in 1912.

Q. In the production machine designing department? A. Yes, sir.

Q. So, you have been in that position now for approximately 19 years? A. Yes.

Q. Now, just in general what is the nature of the work performed in that department under your supervision? A. Well, we plan—when we get new parts for the car we plan the operations, specify the machines and design special equipment where it is necessary, where it calls for high production.

Q. Now, in order that we may understand that thoroughly, I assume, or are we to understand, that, for example, the Ford Company makes a change, and let us limit it first to the engine, a change in the engine, such as changing from the Model T to the Model A, the design of that

particular engine, the Model A, that was all carried out in Mr. Sheldrick's department under his supervision? A. Yes, sir.

Q. And, when they have settled upon the design, and they are ready to release the thing for production, Sheldrick's department then issues engineering information, "Release for production," that is correct? A. Yes, sir. That is correct.

(1112) Q. And, all of this engineering information, particularly on parts released for production, a copy is sent to you as well as to a lot of other executives around the plant? A. That is correct.

Q. Now, when they design a new engine of that type, they make, do they not, a detail drawing of each and every part that is to go into that new machine? A. That is correct.

Q. And, a blueprint of each and every one of those parts, there may be a thousand or more of them, is sent to your department? A. Yes, sir.

Q. Is that correct? A. Yes, sir.

Q. And, suppose you get a blueprint of a new model for the engine, now, you have got all the prints, let us say, approximately how many parts were there in the Model A? A. On the whole car?

Q. No, on the engine? A. On the engine. Oh, I would say about 250.

Q. How about the whole car? A. Oh, about 4,000.

Q. And, are the parts, all those parts, those 4,000 parts then considered in your department as to whether or not you will have special machinery made? A. Well, to answer that correctly, I would have to say no. But—

Q. (Interposing): A great number of parts— A. (Interrupting): A great number of parts would have to come under our supervision.

(1113) Q. And a great number of the parts— A. (Interrupting): We buy a lot of them, outside, and then there are parts that do not require any machines or tools, something like that, your upholstering material and that like.

Q. When the change was made from the Model A, let us say, to the V-8, you got all of these blueprints, and then in your department you made the decision as to the new machinery you would need, and what machinery you had

on hand you could use and all that sort of thing? A. That work is all started in our department.

Q. And that is also true with the change from the Model T to the Model A? A. Yes, sir.

Q. And, do you have any present recollection as to approximately how many special machines, machines for special purpose, what would be called special purpose machines, were designed in your department for the change from Model T to the Model A production? A. Model T to Model A? In our department?

Q. Yes. A. Well, on machinery there would have been, say, 100 special machines.

Q. How many machines did you have to consider the revision of because of change from one model to another? A. From one model to another, oh, I would say 500.

Q. Approximately how many machines, special machines, would you say had been designed in that department since 1919, when you first became assistant foreman in there until the present time? A. Since I became assistant foreman? I would say about a thousand **(1114)** special machines.

Q. Yes. That is what I mean. A. Because, if you consider the special fixtures, and the like, there would be a large figure.

Q. Just what is the practice now that you follow in your department when you get all of these detail prints from Sheldrick's engineering? Let us assume you have got all the prints, and what practice do you follow with respect to any particular part that you may reach the conclusion should, because of production necessities, have some sort of a special operation, a special purpose machine, how do you go about preparing to have a machine of that type built? Do you understand the question? A. I don't.

Q. Well, I am assuming that you have got all of your blueprints from Sheldrick; you have a detail print for a new type of job, a new type of engine, we will say, and you look over these blueprints, and you decide that there is some part of the car, of that engine, for which you should have a special purpose machine? A. Yes.

Q. Do you see that? A. Yes.

Q. Well, then, after having made the decision that there should be a special purpose machine, what do you

next do with it? A. Why, usually get two or three of my assistant foremen and we talk the matter over, and decide just to what—how we are going to design this particular machine, and what principles we **(1115)** will use, and then the next thing we do is decide how many men we can put on that job. We start to make layouts.

Q. That is how many of your draftsmen? A. Yes.

Q. And, what do you start from as your starting point; the blueprint which you get from Sheldrick's department? A. From Sheldrick's department, yes, sir.

Q. And that blueprint, of course, gives you the various dimensions, and you know from experience the operation that is to be performed on the part you are producing? A. Yes, sir.

Q. And that is all you need to know to— A. (Interrupting): To get started.

Q. (Continuing): —to get started in the designing of the machine? A. Yes, sir.

Q. And that is part of the regular everyday practice of your department, to design special purpose machines in just exactly that way, is it? A. That is correct.

Q. In connection with the main record on appeal here, or, rather, the printed transcript of the record, we had some testimony from Mr. Martin, and your name came up with it in connection with a certain trip that you made to Jackson after the Ford Company had received notice concerning the infringement, or alleged infringement, of this Walcott machine. Do you remember anything about that occasion? A. Yes, sir.

Q. Will you just state what happened in that respect? Let me first **(1116)** ask this, when was it you personally first heard of this Gordon patent? A. Well, that was the first I heard of it.

Q. About when was that? A. That was in, I would say, July, 1929.

Q. All right, now, just please tell what you did at that time, Mr. Pioch? A. Well, I was notified by our officials about the Walcott Company having a new head that was supposed to have not infringed on the Gordon patent, and they selected me, they asked me to go down to this Walcott Machine Company and look this over and bring back a report, whatever I thought.

So, I went down there and I went there with, I took Mr. Seaberry along, he worked in the purchasing department, and we both went down there and I looked the head over. And after studying it, I came to the conclusion that if the Walcott head, as we were running it in the shop, infringed, why, this one would be also an infringement. I brought that report back to the Ford Motor Company.

Q. Then, what occurred after that? Were you assigned to any other particular job in connection with the machining of the camshafts? A. Well, it took some time after I got back. I don't remember just how long, but I do remember that Mr. Martin spoke to me one day to start thinking about something else, and then finally, after studying the job over, I happened to strike on the idea of milling these cams instead of turning them, and getting them entirely away from a lathe.

(1117) So, we set up some experiments in the tool room and had a lot of trouble, and found out our difficulties and eliminated them. It took us some time and finally we were successful in doing the job 100 percent.

Q. What did you use for doing the job 100 percent? A. Well, we used the regular standard upright tool room milling machines.

Q. That was just in the experimental— A. (Interrupting): That was just one cutter on the spindle.

Q. And, after that, then what happened? A. Then, I got busy and started laying out a milling machine for it.

Q. Did you personally lay out the milling machine, or did you just merely assign that job to one of your assistants? A. No, I gave that to one of my draftsmen.

Q. And, how long did it take him, Mr. Pioch, after you gave him instructions to proceed, to design the Pioch Milling machine, how long did it take him to get out the designs on that? Do you recall? A. The design or all the drawings?

Q. All the drawings, all the details. A. Well, I do remember the time that we started, and I would say about six weeks. It took us about six weeks.

Q. To make all the necessary drawings? A. To make all the necessary drawings. Maybe a little longer.

Q. Then, how long after that was it before you had the machine operating? A. We had a machine in the first

part of May. That would be **(1118)** February, March, April, May; it took us four months.

Q. From the time— A. (Interrupting): From the time we started.

Q. From the time you first started the machine to get the machine completed? A. Yes.

Q. That job was pushed. Was that pushed as a special rush order? A. Oh, yes, that was very good time we made on that.

Q. You went as rapidly as you could, is that the idea? A. Yes, sir. I put every available man we could possibly use to detail off from the layouts.

Q. Now, when you decided to use the milling method of machining the camshafts, did you at that time know anything about the camshaft shapers which had been used by the Ford Company? A. Yes, sir.

Q. When did you first learn anything about the camshaft shapers? A. Why, I saw them when they were first built.

Q. I don't know whether I asked you on your direct examination how long you had worked for the Ford Company? A. Oh, about a year, year and a half, maybe, when we built the first shaper.

Q. You went to the employment of the Ford Company in? A. 1912.

Q. 1912? A. Yes, sir.

Q. And, you saw the shapers when they were first built? A. Yes, sir.

Q. Did you see them operated? **(1119)** A. Yes, sir.

Q. Did you ever operate any yourself? A. No. I was only interested in the machine because it was at that time an outstanding machine. Back in 1913 there was nothing like it.

Q. Had you, prior to going in the Ford Company, had you worked anywheres as an apprentice boy, or anything like that? A. Yes, sir.

Q. You did serve an apprenticeship? A. Yes, sir, part of it.

Q. Where was that? A. Industrial Works in Bay City.

Q. Now, in view of your testimony saying you knew about the shaper, and it was an outstanding machine, why

was it when you wanted to make the new machine, the new non-infringing machine, Pioch machine, that you didn't use the shaper instead of a Gordon milling type of machine? A. Well, I could answer that several ways. I don't believe we would have gone back to the shapers because from the trials we made in the tool room it showed so much better finish by milling than by shaping, that it would save on the grinding operations. That would be one reason. Another reason would be that from what we found out, we knew absolutely that we were going to get more production with the milling machine.

Q. Than you had— A. (Interrupting): Than we had with the shapers.

Q. In that connection how does the milling machine rank as a machine tool in the shops? I mean by that, from the standpoint of production. **(1120)** Is a milling machine known to any first-class mechanic as being a machine of which you can turn out a lot of work or— A. (Interrupting): Oh, yes.

Q. Or the opposite? A. A milling machine can turn out more than a planer, because you lose your return stroke on a planer or shaper, that is evident.

Q. And, on the question of finish, men who have been in the shop know—state what the type of finish is that you get off a milling machine as compared to other machine tools like shapers, planers and lathes? A. The milling is better.

Q. It always gives a much smoother, nicer finish, does it? A. Yes, sir.

The Master: When Mr. Martin first asked you if you could do something to get away from the Walcott design so as to avoid infringement of the Gordon patent at that time you hadn't, it wasn't until after that time you thought of the milling machine?

A. That is right.

The Master: The problem wasn't presented to you?

A. That is right.

The Master: How long would you say it was before you thought of the possibility of designing a certain milling machine?

A. After he talked to me?

The Master: Yes.

A. Oh, I would say maybe a month or six weeks.

The Master: In the meantime had you given consideration **(1121)** to replacing the Walcott machines with shapers?

A. With shapers, I don't believe so, your Honor.

The Master: It never occurred to you you might go back to the shapers?

A. No, sir.

The Master: With regard to that return stroke in the shaper, that is a pretty rapid stroke, isn't it, as compared with the forward stroke?

A. Yes. It is much faster than the cutting stroke.

Mr. Farley: Now, I might state here that we have taken out from the files—but, I don't happen to have them here at the instant—work orders that had to do with the designing and the building of the Pioch machine, and those work orders substantiate very clearly the elapsed time.

* * * * *

(1131) Q. (By Mr. Farley): How was it, Mr. Pioch, that we have the lapse of from the 3rd of—or, 20th of March, 1930, until the 26th of August, 1930, before the six additional machines were ordered? A. Why was that?

(1132) Q. Yes. A. Oh, that is regular practice. When we put a machine on the job, it is to make a run, oh, say, sometimes two or three months, four months.

The Master: One machine wouldn't turn out your entire production by any means?

A. No, sir.

The Master: So you, at least, weren't certain enough of the success of your machine so as to make a battery of them for production—

A. (Interrupting): Not a battery of six, no, sir; a machine costs too much money.

Q. (By Mr. Farley): And, you ran the machines as these figures show? A. In this case it happened to be five months. You see, an order for six would be almost $100,000.

* * * * *

(1138) Q. Are you familiar enough, Mr. Pioch, with the shaper to understand the operation of it? A. Yes, sir.

Q. When you discontinued Model A production, what type of machines were you using for the machining of the cam shafts? A. Walcotts.

Q. When you discontinued Model A? A. When we discontinued Model A?

Q. Yes. A. We were using the milling machines.

Q. The Pioch machines? A. Yes, sir.

Q. After you discontinued Model A production, you went to the V-8 production, that is correct? **(1139)** A. That is right.

Q. Could you have used the Pioch machines as you used them on the Model A machine, the cam shafts of the V-8 motors? A. No, we couldn't.

Q. What did you use on the V-8's? A. The milling machines.

Q. The Pioch machines? A. Yes, sir.

Q. And, what did you do insofar as the—if you couldn't use the Pioch machines that you used on the A with the V-8, where did you get the Pioch machines that you used on the V-8's? A. We had to build new ones. We had to re-design the machine to fit around the Model V-8 shaft.

Q. Is there anything unusual in that particular procedure? A. No. That is regular procedure.

Q. Of your department? A. Yes, sir.

Q. If you had wanted to use the shaper type of machine for Model A production, you decided upon using the shaper type instead of Pioch machines, could you have used a machine of that type on the Model A shafts? A. The shaper type?

Q. Yes. A. We could have, but we would have to re-design them to fit the A shaft the same as we would the milling machines.

Q. Have you recently, when requested by me to examine into that particular proposition, to decide what, if anything, you had to do in the way of re-designing the shapers? **(1140)** A. I have. You asked me to make an investigation

to see how much work had to be done to use the shapers for the Model A shaft.

Q. And, what did you do in connection with that? A. Well, I immediately turned the job over to one of my men that has charge of the machine designing department, and he immediately started a draftsman on it after we discussed the thing. We studied the design of the shapers and decided which way would be the simplest and best way to go about that.

Q. What was the name of that particular man? A. Mr. Boesen.

Q. In doing that, did you make any departure from your regular practice or procedure in your department? A. Not at all.

Q. And as a result of your assigning Mr. Boesen, and him assigning one of his assistants to the job, did you make any particular drawings? A. Yes, we did.

Mr. Farley: Will you mark these blueprints, please?

(Two blueprints were thereupon marked Defendant's Exhibits 254 and 255, respectively, by the reporter.)

Mr. Farley: I have had the reporter mark two blueprints of the Ford Company as Exhibits 254 and 255. Would you examine those—

Mr. Spohn (Interposing): Just a moment. If your Honor please, at this time we wish to object to the offer, or rather, any testimony at all concerning the change in the machine for a standard of comparison that was never used. There is no testimony on it that it was used, and in connection with (1141) all drawings in connection with that machine.

The Master: Well, we have already considered that at great length, and I will overrule the objection.

Q. (By Mr. Farley): Now, will you proceed to state what those blueprints are, Mr. Pioch (handing documents to witness)? A. Well, these prints represent the design of the machine known as the Ford cam shaft shaper, drawing number 18-Z-3, and they were the machines that produced the production on the Model T shafts.

Q. When were these particular drawings from which these blueprints were made, when were they made? A. They are dated 11/17/13.

Q. And, are they blueprints that you found in the records of your department? A. Yes, sir.

Q. Very well. Now, can you explain to the Court what the blueprints show as far as the general mechanism of that machine as shown by these blueprints in their original form is concerned?

Mr. Spohn: In order to save time, your Honor, I assume this is all taken under my objection?

The Master: Yes. I don't think you need to object to any particular question.

A. Well, this sheet here, which is marked number 254, shows a view, that is a front view of the machine, showing the position of all the tools, which is eight.

Q. Of the whole Model T? A. Of the Model T cam shaft. The cam shaft—

Q. (Interposing): Cam shaft shaper? **(1142)** A. The cam shaft also shows in here very faintly, you can see these cams here, these light lines—there is a Model T shaft shown right in position there, and the way the machine worked, these tools altogether moved back and forth.

Q. The tools moved back and forth? A. And, as they moved back and forth, the shaft itself rotated on its own center, and the tools followed the master cam on top to generate the desired shape of the Model T cam.

Q. Suppose you mark the tools with a "T" there. A. All of them?

Q. Just "T" to one of the tools will be sufficient.

(The exhibit was so marked by the witness.)

Q. And, mark the master shaft, "M" at the top.

(The exhibit was so marked by the witness.)

Q. Now, you stated that the tools moved back and forth. Did the tools move back and forth, or did the cam shaft move back and forth under the tools? A. The tools were stationary. They moved up and down. As the whole carriage on the bottom carrying the shaft, moved in a lateral, sideways, and as the tools returned, your whole slide moved up a little bit. That is so it wouldn't be dragging back on the work piece. Now, that—

Q. (Interposing): Now, I notice some—will you refer now to the other sheet, and I notice some lines in crayon on both of the sheets. Perhaps you better take the

first Exhibit 254 and explain those lines in crayon on the two sheets. A. Well, what we have shown here in yellow represents an attachment that we could have added on to the shapers for the Model A shaft.

(1143) Q. That is an attachment to the shapers as originally constructed? A. Yes, sir.

Q. Without changing the entire machine, is that the idea? A. Yes, sir.

Q. And, can you explain to the Court just what the nature of that attachment is, and, perhaps, in that respect you might refer to the wooden models? A. That is right. That would be better.

Mr. Spohn: Before this testimony is taken, my objection also includes an objection to this line of testimony on this modified shaper, as not disclosed in the account as being standard.

The Master: Well, I will overrule that objection, too.

(The witness stepped down from the witness chair over to the wooden models.)

A. Now, this model here represents, in principle, the action of the Model T shaper as it was built.

Q. (By Mr. Farley): Just a minute, Mr. Pioch, this model has already been referred to, and it is marked Exhibit 237. And, we will mark the other model Exhibit 256.

(The wooden model above referred to was thereupon marked Defendant's Exhibit 256 by the reporter.)

Q. On Model 237 there is an inscription printed on the front, "Model T cam shaper"? A. That is right.

Q. And, on model, Exhibit 256, it is marked? A. "Model A cam shaper."

Q. Very well. Now, will you proceed? **(1144)** A. This Model T cam shaper is made off from the drawings 18-Z-3, and represents the principle that that machine worked on. And, this shows the way the thing worked. It carried the work piece. Of course, you have no mechanism on that. This has a drive shaft coming off here, and going up to the head connected to the master shaft, so everything should be in time, and these tools moved up and down. As this thing went back and forth, this shaft turned around. Now, then, if we go to the other model, representing the same

shaper for the Model A shaft, we would have had to build this attachment out in front of it. And, that shows it is still cutting; we have taken one tool out and one tool out over here (indicating).

Q. You took out—if you will say you took out the tools for the cams, calling the cams by number? A. Calling this one number one, numbered from the front of the cam shaft.

Q. Is that the way you usually number the cams or do you start from this end? A. I don't remember.

The Master: The other witnesses started from the left.

A. I took the other from the rear on that testimony.

Mr. Farley: All right, number one cam.

A. Number one from the front, and number five.

Q. (By Mr. Farley): And, from the front you are referring to the large flanged end on the cam shaft? A. Yes, sir.

Q. Very well. A. And, we have taken the number one cam tool and number five cam **(1145)** tool, and placed it on this attachment that we could have built on the front of the machine. Now, this here clearly shows that with the same mechanism, they are both identical, taken off from the prints, that we could have added this attachment on there and cut off all the cams. The principle of that is this shaft that comes out in front of the machine housing, all we had to do was put this bell crank on here, and this bell crank.

Q. Just a minute, let us mark these shafts with the letter "S." When you say this shaft which comes out at the front, which I have just marked with the letter "S" on Exhibit 237, what is the function of that particular shaft? A. That is the shaft that has the lever keyed to it that moves the carriage that holds the work piece.

Q. Now, do you have a similar shaft "S" on this other model? A. Yes, sir.

Q. Exhibit 256? A. Yes. A shaft extended.

Q. Yes. A. And, a similar lever keyed to this shaft with a radius two times of the lever that moves the carriage that holds the work piece. The reason for that is so that the tool, that is the carriage that holds the tool, moves twice as fast with the same cutting speed as the other tools.

Q. And, the two tools which are on the attachment, they cut the cams, just the number one cam— A. And number five.

Q. (Continuing): —and number five, by attacking the cam from the opposite direction? **(1146)** A. Opposite side.

Q. And the opposite side from which the vertical tools attack the cam as in the Model T job? A. That is correct.

The Master: But, you have a double movement of the horizontal tools, an additional movement over and above that that you have on the vertical tools?

A. That is right.

The Master: Because there is an in and out movement, and also a sideways movement, as they cut?

A. Yes, they have that in here, too. There is a master cam attachment.

The Master: In other words, two movements of the tool with the extra tools, you have set up here horizontally, and you only have one movement of the vertical tools?

A. Yes, that is right.

Q. (By Mr. Farley): The extra movement of the tools to which the Master refers were the two tools— A. That is the lateral movement and the in and out.

Q. That is, the extra movement is to perform the cutting stroke? A. That is right. The one movement performs the generation of the cam, and the other movement performs the cutting of the cam.

Q. Now, let me ask you, Mr. Pioch, with that operation of the attachment, is that the type of a shaper action or shaper machine? A. That is right.

Q. In the conventional shapers is the cut performed by the action of the tool traversing the work, or by the work traversing under **(1147)** the tool? That is the standard shaper. A. A standard shaper the tool moves and the work is stationary. And, in this shaper it does both.

Q. Now, insofar as the mechanism for operating the attachment carriage, which is located in front of the machine is concerned, can you state whether or not that fol-

lows ordinary shaper practice, or is it anything different? A. It is not different. It is the same as the shaper practice.

Q. The mechanism for imparting that movement is the same? A. That is right; the same.

Mr. Farley: I wonder now if you would let us go back to the blueprints and point out to the Court the driving mechanism for reciprocating the carriage in the old shaper.

(The witness thereupon resumed the witness chair.)

Q. Let me first ask, you are familiar with the type of driving mechanism used on what we would call the standard production shapers? A. Yes, sir.

Q. And, would you state whether or not what difference there is, or if there is any difference between the driving mechanism and the ordinary shaper drives? A. There is no difference.

Q. Now, just explain to the Court the peculiarities and functions of the standard shaper drive as it is shown in this particular drawing, Exhibit 254 (indicating)? A. Well, here is—I don't know just how to start this—here is driving member rotating above this point.

Q. Let us get some reference characters as we go along. Starting **(1148)** with 1, I think, would be simpler. Just use Roman numerals. Put the number "I" on that line you put to the shaft.

(The exhibit was so marked by the witness.)

Q. And, that is the— A. That is the driver.

Q. That is the main power of the shaft? A. Yes, sir.

Q. Starting with that? A. And, this is number 2, is the driven arm. Then—I can't decipher this thing here—there is a bell crank in here, which we would have to call number "III" from here to here (indicating), and that bell crank is attached to the slide. We will say this is the bell crank number three (so marking the exhibit).

Q. It is attached to the slide "4" let us say? A. The slide 4 (so marking the exhibit).

Q. "4," the slide, is the same as the carriage? A. The work carrier.

Q. Yes. A. Now, then, as this rotates, it imparts a motion.

Q. As what rotates? A. As "I" rotates, it imparts rotation on number 2, and that in turn imparts rotation on bell crank, number three, and that moves number four back and forth.

Q. That is the conventional shaper drive, is it not? A. Yes, sir.

Q. Now, what additions, if any, did you make as shown on the drawings here for that drive? **(1149)** A. Well, as the wooden model shows, we extended shaft "S" as shown on the model.

Q. Which you have numbered "3"? A. And fastened the bell crank on the extension of this shaft. This bell crank, having a leverage two times of the one on the inside, that imparts motion to the work slide. Now, this new lever imparts motion on the added attachment in front of the machine that carried tools for cutting cams numbered one and five.

Q. Now, have you had Mr. Boesen, or anyone in your department, prepare any additional drawings which show just merely the attachment in a little more simplified form? A. He did.

Mr. Farley: I will ask that the new drawings, these drawings, be marked Exhibits 257 and 258.

(The two drawings above referred to were thereupon marked Defendant's Exhibits 257 and 258, respectively, by the reporter.)

Mr. Farley: And, they are 18-Z-3, and one sheet is entitled, "Assembly," and another sheet is entitled "Sub-assembly," each machine having the main title, "Special machine for shaping eight cams on cam shaft at one time."

Q. (By Mr. Farley): Now, will you refer to the sub-assembly, first assembly drawing, Exhibit 257, and point out the parts shown on there which show the same representation as you have in the wooden model, putting a suitable reference number on it? A. Well, we mark this shaft number one again—no, that is on the bell crank shaft.

Q. That was letter "S"? **(1150)** A. Yes, letter "S," "letter 'S' of wooden model." That shows the added

bell crank keyed on to this shaft "S." This bell crank imparts the motion on the added slide that carries tool number one and number five.

Q. And, the carriage with the added slide or tool attachment, will you give that a reference character? A. The tools numbered one and five are held in a tool slide, tool holder and slide, that are held against the added master cams by spring pressure. This principle is the same as the tools in the vertical head.

Q. Now, how about the attachment, Mr. Pioch, for operating the master cams to control the tools 1 and 5, did you make any change in those? A. No, sir. All we did was to take, shown on Exhibit 258, the upper center—will I label that?

Q. Yes. A. The upper center marked "A" (so marking the exhibit) is the original driver for the master cams on the original machine. And, in order to furnish a drive for the added attachment, we add a gear marked idler gear and driven gear, which connects to the new gear that is keyed to the added cam shaft.

Mr. Farley: I have another drawing, again marked 18-Z-3, and marked "Assembly," I will ask that it be marked Exhibit 259.

(The drawing above referred to was thereupon marked Defendant's Exhibit 259 by the reporter.)

Q. And, I will ask you what that drawing represents? That is what we call a front elevation of the machine (handing document to **(1151)** witness)? A. That is what we call a front elevation of the machine; the top part of it.

Q. And, it shows the space where the two tools have been removed? A. Yes, sir.

Q. For cams one and five? A. Number one and five.

Q. And, on the upper part where the master cam "M" is, the master cam— A. (Interrupting): Has been removed.

Q. The two master cams have been removed? A. Yes.

Q. Suppose you mark that master cam "M"; I think that is what you marked it in the other drawing.

(The exhibit was so marked by the witness.)

Q. Now, in connection with these drawings and these wooden models, Mr. Pioch, these were prepared, as I un-

derstand it, on the basis of making what might be termed the cam change in one of the existing model T cam shapers had one been available as a physical machine at the time? A. Yes, sir.

Q. Now, these drawings which were prepared by Mr. Boesen, would you say whether or not there was any particular departure from the principles of practice of your department in that respect? A. No, sir. That is our regular procedure. There is nothing unusual about this.

Q. Could you state as to whether or not, or would you have any opinion as to whether or not a machine constructed in that **(1152)** manner would function and operate? A. Pardon?

Q. Have you any opinion as to whether or not, had you actually built this machine on an old shaper, if you had one available— A. (Interrupting): Yes.

Q. (Continuing): —could you state whether or not, in your opinion, it would operate? A. Oh, yes, this would operate; of course.

The Master: May I ask this in that connection?

A. Yes, sir.

The Master: Would you be so certain this machine would operate as to feel safe if, for example, you hadn't developed the milling machine at the time you did, to go ahead and build enough machines for the entire production without first building a testing machine?

A. Well, your Honor, I believe we had at the time we were notified of infringement at the time, if we had any of these shapers around we would have used them immediately.

The Master: Suppose you had no shapers around, but hadn't been able to develop the milling machine, or hadn't thought of the principle of it, and you decided, however, to replace the Walcott machines with shapers as modified in this style?

A. Yes.

The Master: Would you have felt certain enough that your modified shaper would be workable and successful so that you could have immediately or-

dered eight or ten shapers, or the number necessary to do the entire production on the cam shafts, or would you have done as you did with the milling machine and **(1153)** built simply one shaper first to test it out, and then ordered the rest?

A. I believe in this case, being that the shapers ran for such a length of time, that we would have ordered more than one. I am sure of that.

Q. (By Mr. Farley): May I ask, Mr. Pioch, if you had been confronted with the problem at the time the Model A shaft and the Model A production got into the picture, let us assume you had on hand—or with the conditions just as they were, that is, the shapers had been already salvaged, they were no longer available as a physical proposition, and it was decided before Model A production started, that you were going to use the shapers again, just how would you have gone about that?

Mr. Spohn: Just a moment, what was that question, again?

(The last question was thereupon read by the reporter.)

A. Why, we would have designed the shapers just as they were, showing the added attachment as we have seen in this wooden model.

Q. (By Mr. Farley): Did you consider at all, in connection with this particular idea of the availability of the shaper method, any other type of construction than as shown in these particular drawings, which we have just been discussing? A. Well, if—let me put it this way—if we hadn't had the shaper design as we see it today, we probably would have designed this shaper in principle as is, but with one tool on number one cam on the front side, number two cam on the back side, and so on, alternately, down to the end of the shaft. That would be better than the condition we have shown in our model, because the pressure of this tool would neutralize the pressure of the **(1154)** tool on the next cam on the opposite side, and so on down. You could have done that.

The Master: You could not have done that without bearing interference in the Model A shaft, could you?

A. Yes, we could, your Honor, because we would have had one slide as shown here, and then we would have had a slide on this side. This slide on this side in the front would cut towards the left, and the slide in the rear would cut towards the right, and there would be no interference with the bearings.

The Master: The work piece would remain stationary?

A. Yes, sir. I say, had we not seen this design. I was only citing there the way we attack a job; that is, if we didn't know anything about this, that is the way we would lay this out.

The Master: I might ask this question. When were you first asked to give attention to the problem of re-designing the shaper to fit the Model A cam shaft, or produce the Model A cam shaft?

A. On the shaper?

The Master: Yes, sir.

A. That is the date of this drawing (examining blueprint), we started that—I hope there is a date on here somewhere, there must be a date on there, no, there isn't. That is funny.

The Master: Do you remember the approximate time?

A. It was last summer, I think. Maybe 9 months ago, 6 months ago. I wouldn't say exactly.

Mr. Spohn: Some time in 1938?

A. Yes, sir.

The Master: Did you ever discuss the problem in a general **(1155)** way before with Mr. Farley?

A. Not before the date that—the time he asked me to consider that.

The Master: All right.

Q. (By Mr. Farley): Do you recall whether or not you talked with Mr. Woehrle about that matter before you discussed it with me? A. I don't remember.

Mr. Farley: I will show by Mr. Woehrle, if the Court please, this was all done prior to our filing—in preparation of our accounts.

Q. (By Mr. Farley): Now, I wonder, Mr. Pioch, you know, or stated part of your duties was to know, whether or not any new production machinery, particularly special purpose machinery purchased by the Ford Company such as these Walcott lathes, result in any savings or not, to the company? A. Yes. We make investigations.

Q. Do you know whether or not the Ford Company effected any savings by the use of the Walcott machines? A. By comparison?

Q. Yes, by comparison, let us say, with the shapers, over the cost of machining the shafts over the shapers? A. Well, I doubt if there was any saving made with the Walcott machines, comparing it with the shapers. I know this much, that we had about, oh, possibly six tool makers in the department where we ran the lathes, and I don't ever remember seeing any tool makers around in the shaper department, when they were running. That is, they might have produced a few more pieces an hour than the shapers did, but the cost of maintaining the **(1156)** Walcotts would surely, maybe, more than eat up the profits made from the extra production that the lathes produced.

Q. Do you happen to know anything at all whether or not there was any differences in the manner in which the shafts were prepared for operation on the shapers, and for operation by the Walcott machines? A. Well, we added an operation to straighten the shafts for turning on the Walcotts so that the finish, the stock had to be removed to be more uniform than when we used the—cut on the shaper, because the shaper tool could stand for more unevenness of stock than on the lathe.

The Master: Why is that?

A. Well, in turning on the lathe, it was bad enough even if you had stock around the cam for that tool to slip around that end; where, on the cam shaper, it had to shape an irregular-shaped piece. In travelling across it laterally if you hit a hump it wouldn't damage the tool as near as much as you would a tool trying to swing around that nose, because the cam shaft shaper was no more than finishing a straight surface. That is the work it was doing. You could say the principle of the cutting of that surface is no different than cutting a straight surface.

The Master: Well, would that difficulty you speak of be remedied by straightening the shaft? Wouldn't that be a question of getting as correct a forging as you could possibly get?

A. Yes.

The Master: You might have a perfectly straight shaft and still have humps?

(1157) A. Yes, but all forgings, after they cool off, after the forgings cool off, they distort somewhat. That would give a tendency for this cam to be off center, say, 1/16th of an inch more on one side than on the other. So, we had to straighten those shafts to eliminate—

Q. (By Mr. Farley, interposing): You always had that operation of straightening after?— A. After machining. We always have a straightening operation after machining. But, the straightening operation before the machining was added for the Walcotts.

Q. You always did have the straightening operation, however, in the very beginning after the forgings came from the Ford shop? A. Yes, sir.

The Master: Some of the other witnesses who testified here stated the reason the straightening operation was necessary on the Walcott machine, and not on the shaper, was because the pressure of all the cutters in the shaper was immediately vertical and downward, and the camshaft underneath the shaper tools was resting on five supports?

A. Yes.

The Master: So that as the tools travelled across the camshaft, the pressure of the tools straightened the shaft while the operation was being performed, although it might swing back after 1/16th of an inch.

A. Yes.

The Master: Whereas, in the Walcott machine the shaft was swinging more freely in space?

A. Yes.

The Master: There was simply the center rest to steady it, **(1158)** which the witnesses testified was not

as steady as a support with the rigid supports underneath?

A. That would be a reason.

The Master: You have a slightly different reason?

A. I am giving you my opinion. That is, I think, really the main reason why they straightened them.

The Master: The reason you gave or the reason the others gave?

A. The reason I gave. They had to straighten those shafts to make them straight.

Q. (By Mr. Farley): How about the reasons given by the other witnesses? Would that also be a fact? A. I didn't hear that.

Q. The situation Mr. Quaife just outlined? A. That would also be another reason for straightening the shaft, yes. I hadn't given that a thought.

The Master: As far as that reason is concerned, the re-designed shaper you designed for the Model A, it would be open to the same objection as the Walcott lathe was, and if anything, in a more aggravated form because there you would have been having a pressure in two different directions, and it wouldn't have been all on five supports?

A. That is right.

The Master: So, can you state, would it be your opinion with the re-designed Model A shaper, it might become necessary to add the straightening operation which you didn't need with the Model T?

A. I think I explained to you, if we completely re-designed the **(1159)** machine, we would have put a bank of four tools on one side, cutting in one direction, and a bank of four tools on the other side. Had we had shapers, we would have added that to the shapers. That wouldn't have taken us ten days time to get those shapers into operation.

The Master: Let us limit our inquiry to the shaper which you re-designed, which did not have the four tools on the opposite sides, but the one which is represented by the wooden model and the drawings you

produced here. With that particular re-designed shaper shaping the Model A camshaft, could you state whether it would be your opinion whether a straightening operation might be necessary or advisable immediately before inserting the shaft in the shaper?

A. Well, I wouldn't say it would be absolutely necessary, but there is a possibility. But, as far as taking care of the tool life, the straightening operation would be no more necessary with that attachment.

Q. (By Mr. Farley): That is, than with the original? A. Than with the original shaper.

Q. You are stating, when you are discussing the operation of the Model T shaper, and particularly with reference to this straightening operation— A. Yes.

Q. (Continuing): —that your tool was performing what was substantially a cut on a plane in a straight line? A. That is right.

Q. Now, would the placing of the extra attachment in the front of it in any way change that principle of operation? A. It would not.

(1160) The Master: If there were a tendency of the shaft to spring under the pressure of the tool, however, the tools which you have on your re-designed shaper from the front would tend to push the shaft backward toward the rear of the machine?

A. That is right.

The Master: And, might not take off as much stock as would be necessary.

A. You see, these extra bearings are made like this (indicating). Now, your shaft lays in here. Any pressure of that side tool there in this direction, this bearing would back it up just the same. I see the point you are getting at now. You mean there would be a spring in the shaft?

The Master: That was the main reason that the other witnesses have given for the straightening operation. I realize you have another one. But, I was looking at it from another angle.

A. This bearing here would overcome any tendency of this tool, the pressure of this tool, in this direction.

Q. (By Mr. Farley): Of the two front tools? A. Yes, sir. This bearing here would support that. It would still support that, although on the top it is open where the other tools were. We have many cases like this in operation today in the plant.

The Master: Wouldn't it have been a simple matter with the Walcott machines to design additional steady rests to give additional support to the tools so that there would be no more springing in the shaft than with your rests in the shaper?

A. Well, my opinion is that it wasn't the trouble with the shaft **(1161)** springing; it was more trouble with the tool springing in the Walcott machine.

The Master: From the standpoint of the springing of the shaft, you don't think there is very much difference between the shaper and the Walcott?

A. No, sir.

Q. (By Mr. Farley): On the question of the additional steady rests in the Walcott machine, did you consider, before answering that, the fact that in the Walcott machines, the tools attack the work from the back, do you remember, in the Walcott machine? A. Yes.

Q. All of your eight tools are behind the shaft toward the rear of the machine? A. Yes.

Q. And, the operator puts the shaft in from the front? A. Yes.

Q. How would that affect the problem of using additional steady rests? A. Let's see, does that represent the tool there?

Q. No. Here is your tool over here? A. Oh, this is the master.

Q. This is the master. A. Oh, that is right.

Q. Now, you have your camshaft running across the front of the machine? A. That is right.

Q. And, the front of the machine is to my left here? A. Yes.

(1162) Q. And, you have on the Walcott machine one steady rest which engages the center bearing? A. Yes, sir.

Q. Considering the fact that the Walcott tools came in from the back, what would you say as to the feasibility of adding additional bearings such as his Honor has sug-

gested along the shaft such as of the type you were talking about, additional bearings that would resist the tool pressure? A. I believe that could have been added in there. It wasn't though.

The Master: I might ask this—

Q. (By Mr. Farley): How would that affect your loading conditions if you tried to put several bearings along the front of the machine that are going to resist the action of the tools coming from the back? A. Well, it would have slowed the loading time down.

Q. Suppose you put in an arc shaped, a steady rest on that of an arc shape like bearings, steady rest bearings like you used on the shaper? A. Yes.

Q. As that rests there, there are some circular recesses exactly opposite the thrust of the tool? A. Yes.

Q. If you were going to put a bearing of that type on the Walcott machine, you had to have your rest in that position with the opening directly toward the back, would you not? A. Yes.

Q. And, you are going to load the machine and have eight tools in **(1163)** back of the machine that are already positioned? A. Yes.

Q. And then you are going to have to put the shaft in? A. The steady rest would have to be towards the front.

Q. How are you going to get your steady rest or your shaft like this (indicating), around the steady rest, bring it forward into the steady rest and clear the tools? A. I don't know. That could be—it might be done. I don't know. We will have to figure that out.

Q. I would like to see you do it. A. It is just another problem. We can work it out for you. I always work on the assumption that there is nothing impossible as long as—

Mr. Michael (Interposing): I suggest you just add a steady rest like the Walcott lathe had on it.

The Witness: We are talking about adding more steady rests.

Mr. Michael: Yes.

The Master: What actual study did you make of this straightening problem, or what attention did you give it before? Was it brought before you at the time

they were considering adding the straightening operation on the Walcott machines and using the Walcott machines?

A. No, I couldn't say, because I really believe the straightening operation was added to eliminate the many troubles they had with those machines, to help the machines produce.

The Master: When did this problem which necessitated the straightening operation in the Walcott machine come to your **(1164)** attention before being brought up at the present hearing?

A. I would say after it got started. The shop men started that. We had nothing to do with that.

The Master: What critical attention or study have you given to the cause which required a straightening operation on the Walcott machine when it wasn't necessary on the shaper? Are your judgments and ideas on that more or less offhand ideas?

A. Taken from the shop men. Our department had nothing to do with the straightening operation, although I do know they added the straightening operation.

The Master: Are you familiar with the difficulties they had with the Model T cam shaper in the early period of its operation due to filings and chips from the metal of stock that was removed from the cams getting into the slides and preventing them from operating smoothly?

A. I wouldn't say.

The Master: Are you familiar with the fact a guard was put onto the machine?

A. No.

Mr. Michael: You said "shapers," I think, your Honor.

The Master: Wasn't that true of the shapers? I think that was the testimony of one of the witnesses.

Mr. Michael: I didn't recall that.

Mr. Farley: I think that is right.

The Master: He said they had no trouble with the shaper except in the beginning—

The Witness: (Interrupting) That was done in the shop.

The Master: I was wondering wouldn't it be more difficult **(1165)** to put such a guard on the re-modelled shaper for the Model A cam shaft which you have embodied in the wooden exhibit there.

The Witness: That would have been before my time.

Q. (By Mr. Farley): Mr. Pioch, looking at your wooden model there suppose you come over here for a minute.

(The witness stepped down from the witness chair over to the model above referred to.)

Q. (By Mr. Farley): The former witness, I believe John Schmidt, explained that they put a guard on here to prevent chips from getting down the slide? A. In the ways.

Q. In the ways. As I understand his description, and obviously knowing what the problems are, that would have been simply a piece of tin placed over the slide? A. That is right.

Q. And, extends out over here? A. That is right.

Q. So that on the full travel, the opening would remain closed? A. Like as not, that guard probably was around the top of this and came off the side here so that the chips would all fall down. I don't know.

Q. Insofar as that is concerned, would it have been any more difficult putting a guard of that type on the so-called Model A? A. No.

Q. Than there would on the Model T.

The Master: You couldn't extend the guard in the front?

A. No, not in the front, but you could extend it around here all **(1166)** the way to the back. Yes, you could; all the way around the front (indicating). You could have a telescoping guard, a guard on top of this, and one on top of that, and one would be sliding over the other like this. There is nothing impossible.

* * * * *

(1174) Mr. Farley: I don't think I have offered these exhibits. I will offer Exhibits 252 to 261 in evidence; 252 and 253 being the work orders, and I think the others being the drawings—254 and 255 being the drawings of the cam shaft shaper originally made in 1913 with the crayon additions more recently made; Exhibit 256 being the wooden model of the cam shaft shaper; Exhibits 257, 258 and 259 being the more recently prepared drawings of the modified cam shaft shaper attachment; and, 260 and 261, the two drawings showing the quick acting tail stock.

* * * * *

(1176) The Master: Where are the supports subjacent to the cam shaft shown on Exhibit 254?

A. Will we mark them? Right here (indicating). There and there.

The Master: How many does that show?

A. It shows three.

The Master: Is that three in addition to the head stock and tail stock supports?

(1177) A. Yes, sir.

Mr. Farley: Suppose you mark them with the reference character 10.

A. "10"? We can mark it "Support." Here it is identified as detail 152 (indicating).

Mr. Farley: I see.

A. And detail 153. And, this one is not marked (indicating), it is probably marked on another sheet.

Mr. Farley: Just mark them "10," that will be the simplest.

(The witness thereupon marked the exhibit.)

Mr. Farley: Those represent three steady rests on the machine, is that the idea?

The Witness: That is right.

The Master: You testified that the wooden model, the Model T cam shaper, was constructed in accordance with these drawings?

A. Yes, sir.

The Master: Without giving all the detail parts that you have in these drawings?

A. Yes, sir.

The Master: That illustrates the principle of operation?

A. Yes.

* * * * *

(1179) Mr. Farley: While they are looking for that, I might ask the witness one further question, I think I am about through.

Q. (By Mr. Farley): Mr. Pioch, the plaintiffs here have filed a certain statement of account in which the major figures, and by far the largest proportional part of their claim against the Ford Company, is based on the assumption that if the Ford Company had had those machines available for use, and had not used the Walcott machines, it would have been compelled to use Landis grinders for the rough machining of the cams of nearly five million Model A cam shafts. What have you got to say about that?

Mr. Spohn: Just a moment, will you read that question back?

(Last question was thereupon read by the reporter.)

A. At that time—

Q. Do you understand the question? A. Yes, sir, I understand the question all right. At that time my opinion is that it would have been almost impossible to use the grinders because the grinders are too slow. We would never have thought of going back to grinders; never.

Q. Do you know whether the Ford Company ever used grinders for machining the cam shafts of any of the large production jobs, Model T— A. (Interrupting): From the rough?

Q. Yes. A. No, sir.

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(1186) Q. Now, the question was asked, as I recall it, by the Master, of one of the witnesses who preceded you on the stand as to why, or rather, concerning the purchase

of the Walcott machines in 1929. Were you familiar with the fact that the Ford Company in the early part of 1929 purchased additional Walcott machines? A. Yes.

Q. And did you know for what purpose they were purchased? A. Yes. The one reason was they had to have more machines on account of their production, and the other reason was they had to have additional machines to improve the finish as they were **(1187)** adding on a third cut.

Q. That was the intention, to use the additional Walcott machines to take a third cut? A. Yes, sir.

Q. And that would have been for the purpose to reduce the work on the, or the time on the finished grinding, wouldn't it? A. That is right.

Q. Now, why did you not, when you purchased those additional machines in 1929, employ a shaper for that operation? A. Well, as I remember the time in 1929, we were so crowded for cars, our production was so high, it would have been impossible to resort to another type of machine. We did not have any shapers and it would have taken us at least six or seven months to build them, and it would have been like trying to change horses in the middle of a stream.

Q. At that time do you know whether or not in 1929, any of the original patterns for the manufacture of shapers were available? A. They were not.

Q. Do you know whether all of the detailed drawings of the original shapers were available? A. They were not. All we had left were the assembly prints.

Q. Now, if you had decided, however, to use the shaper at that time how would you in your department have gone about doing it? Would you have taken your detail prints, as you already described that you received from Mr. Sheldrick's department, and proceeded? A. That is the regular procedure.

Q. And you would have designed the cam shapers? **(1188)** A. The cam shapers from the part itself. That is regular procedure.

Q. Do you know whether or not the Walcott machines which you purchased in 1929 were machines that were available on the market? A. They were.

Q. Do you have any knowledge, Mr. Pioch, concerning the practice that is followed by the company in connection

with the purchase of machines on which, and I am speaking of production machines— A. Yes.

Q. —on which they know there are patents covering the particular type of machine. What would you do in that particular instance? Suppose you wanted to buy a machine for the production, let us say, of a special purpose machine, and you knew that someone had a patent on that particular type of machinery. Do you know what would be done under those circumstances, or would that come under your supervision? A. I am not in the purchasing department, Mr. Farley, but I know when a machine is purchased that is covered with a patent, the company buys that machine with the understanding that the manufacturer of that machine will back up the rights of that patent; that the Ford Motor Company will not be responsible for that. I know that much about it.

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(1189) Q. (By Mr. Farley): Do you know whether you make any effort to purchase patented articles, whether for production machinery or for the cars directly from the owner of the patent or not? A. Yes, we do. I know that.

Q. You always make it a practice to purchase from the owner of the patent? A. Yes, sir.

Q. As long as his device is satisfactory? A. That is correct.

Q. Suppose the device of the owner of the patent would not be satisfactory, what would you then do? A. Why, we would try to design around the patent, get away from it.

Q. Do you know of any recent instances where any purchase of material and special purpose machinery has been held up by the company on account of the question of patents being raised? A. Crankshaft machines, crankshaft turning machines.

Cross Examination by Mr. Michael.

Q. Do you know of any instance prior to that, Mr. Pioch? A. Walcott lathe.

Q. Any other? A. I do not.

Q. With the exception of your training at the Industrial Works in Bay City, did you get all your training at the Ford Company? **(1190)** A. No, sir.

Q. Where else did you get your training? A. I worked for Ammerman & McColl in the Penobscot Building. McColl, he was from the University of Michigan.

Q. And what was the nature— A. And then—

Q. Go ahead. A. Then I worked for Bantam Motor Truck Company, and then after that I worked for the Trio Manufacturing Company. From there I went to Ford's.

Q. Now, what was the nature of your experience prior to going to Ford's? A. Prior to going to Ford's? Well, I worked two years as an apprentice, then from there I went to the drafting room. That is at the Industrial Works. I worked in their drafting room for two years.

Q. Was that in the nature of design and development work? A. Yes, sir.

Q. Go ahead? A. And then I worked for Ammerman & McColl and there we did general engineering work. They were consulting engineers. They took on all kinds of work.

Q. All sorts of problems in various industries? A. Yes, sir.

Q. It was not limited to any one industry? A. No. They were listed as consulting engineers.

Then from there I went to the Bantam Motor Truck Company on engineering. I worked on the engine, designing the engine.

(1191) The first one we designed was a two-cylinder one, and then the next one designed for that truck was a four-cylinder one, similar to the Ford engine, four-cycle, and then from there I went to the Trio Manufacturing Company, and they were manufacturers of automobile parts.

There I worked in the drafting room as a designer and also in their tool room as a tool maker.

And then at Ford's I worked in the tool room there and in the designing department.

Q. When you first went to the Ford Company? A. I went there as a draftsman.

Q. Then to the tool room? A. Yes, sir.

Q. And then to the present department? A. Then back in the present department.

Q. How long was it after you went with Ford that they put you into the designing and developing department? A. I did that right from the start.

Q. You went right into that department? A. Yes, sir.

Q. Then a short time later, how long later was it, you went into the tool room? A. The tool room? Let's see. 1921. 12. 9 years.

Q. You were in the tool room? A. 9 years. No, you asked me how long was it that I went in the tool room.

Q. How long after you first went with the company that you went to the tool room? **(1192)** A. That was 9 years.

Q. You were in the designing and developing department 9 years? A. That is right.

Q. And then in the tool room one year? A. Yes, sir; and then back in the designing.

Q. What was your position in the designing and developing department when you moved into the tool room? A. I was made a foreman shortly before I went into the tool room.

Q. Foreman of what particular work? A. In the designing department.

Q. Designing what? A. At that time I didn't have the office I have now. We did everything, machinery, jigs and fixtures, multiple heads, gauges, chucks and dies, all the equipment necessary for production.

Q. And you were a foreman at the end of 9 years? A. That is right.

Q. You had been there how long? A. Two years. I was made a foreman, I believe I testified to that, in 1919.

Q. And how many other foremen were there in that department when you became a foreman? A. Well, there were two more besides me.

Q. Now, was this move into the tool room in order to give you broader experience? A. I don't know what the company had in mind, because it was not long after I got back into the drafting room, after working in the tool room for a year, and then they made me a direct assistant **(1193)** to Mr. Emde, who was chief.

Q. He was the chief of the department you now head? A. Yes, sir.

Q. How many men would you say were employed in your department now? A. I have about 135 draftsmen. That is not the exact figure, but it is within five.

Q. And the number varies from time to time? A. Yes, it does.

Q. I think you said it did. A. At one time we had 483, I think is the exact figure.

Q. How are the men picked for your department? A. I pick them.

Q. Well, from what source or sources, or what are the qualifications you demand in a man you pick? A. Oh, we like to get men who have had shop experience and some technical training and they should be versed in higher mathematics and be able to make a neat drawing.

Q. How are the foremen selected in the department? A. I am doing the selecting since I have full charge, and I select those for their ability that they show when they are on the board.

Q. Ability in designing and developing? A. Yes, sir.

Q. Now, tell us a little bit how your department functions. Suppose there is a machine giving trouble in one of the various departments in the plant, how does that get to your knowledge? A. We are notified by the building superintendent.

(1194) Q. If a machine was giving trouble, you wouldn't know about it, except through the building superintendent? A. That is right.

Q. And when he notifies you, state what is done then? A. Why, we immediately examine it. If it is serious enough I go down myself, and if it is not so serious, why, I send one of my assistants down and he usually takes a draftsman or designer right with him.

Q. How many machines of a special character would you say that you personally designed and developed, or had anything to do with the design and development of during your stay in this department? A. You mean while I was on the board?

Q. No, while you have been in the department, from the beginning to the present time? A. From 1912?

Q. Yes. A. You mean personal contact?

Q. Yes. A. Oh, I would say in rough figures 200.

Q. Now, amongst those 200 there were, no doubt, some very outstanding and ingenious and intricate machinery, isn't that true? A. Yes, sir.

Q. Could you name a few of them without divulging any secrets? A. Yes, sure.

Q. A few of the outstanding machines you have developed?

Mr. Farley: We don't have any secrets.

A. No. I can remember the first special machine that I designed myself, and that was the machine for the magneto coil. This **(1195)** machine pulled the coil tight, sized the hole and sealed it, locked it, all in one operation. That was done separately in the department before that. That is one.

Q. That was all automatic? A. Oh, yes.

Q. There never had been any machine like that before? A. Not before then, no. And there is a machine for rolling the roller bearing sleeve to size, cam shaft milling machine.

Q. There never had been anything like that before, either? A. No, no. A press for making cylinder sleeves. That is just recently. We are working on that. Do you want me to name all of them?

Q. I just wanted a few of the outstanding ones? A. Those are the outstanding ones.

Q. Your men never go about the shop looking for trouble, do they, I mean, observing the operation of machines and seeing if you can improve them? A. No, sir; that is the job Mr. Herklotz has.

Q. Does he do that? A. Yes, sir.

Q. He is in your department? A. Not any more, no.

Q. But he has contact with your department? A. Yes, sir; direct.

Q. Does he ever come to you direct? A. Oh, yes, every day.

Q. If such a machine isn't working well? A. That is right.

(1196) Q. How long has he been in that capacity? A. He was doing that when I came to the Rouge. That was in 1926.

Q. Does Herklotz have a staff directly under him? A. Yes, he has, I would say, roughly, about six or seven men. That work was at one time right in our department, directly in our department, and then we segregated that, because it really didn't pertain directly to designing so we separated that part of it.

Q. Then you have two sources from which you may get information or instructions as to the operation of a machine in the plant, is that right, one through the building superintendent and the other through Mr. Herklotz? A. And sometimes from the department foreman, too.

Q. From the department foreman? A. From the department foreman, yes, sir, and then sometimes just through a communication, not a telephone call, just a regular communication that goes on the record.

Q. Suppose the department foreman told you that a machine was not working as well as he thought it should, would that be enough instruction or authorization to your department to do something about it? A. Yes, sir.

Q. And the same would apply to Herklotz? A. Yes, sir.

Q. Any other sources? A. Oh, I would say that about covers it.

Q. Well, now, you have been head of this department since when? A. 1926.

(1197) Q. 1926? A. Yes, sir.

Q. During the time you have been head of the department have you received from any one of those sources any complaint of the operation of the Walcott lathe? A. In which way?

Q. That they weren't performing satisfactorily? A. Oh, I would say that Mr. Herklotz took care of most of that trouble.

Q. What trouble? A. That they had on the Walcott machines.

Q. But no complaint or information about it came to you? A. No, sir; not that I remember.

Q. And so far as you know, there was nothing at any time done in your department respecting the Walcott lathes? A. No, sir.

The Master: Do you think you would know about it if something had been done in your department?

A. I believe so.

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(1200) Q. What do you personally know about this third cut you spoke of on the Walcott machine? A. I know it was added.

Q. You know they actually used some or all of those six machines to take a third cut? A. I wouldn't say that.

Q. Were the six machines bought in 1929, just the same as the ones you had, Walcott machines you had? A. I believe so.

Q. When, in your department, do you determine to destroy patterns or drawings? A. When the pattern loft gets all clogged up.

Q. Whether the machine is of any value or not? **(1201)** A. Usually it is machines that have been discontinued.

Q. You consider them obsolete, do you not? A. Yes, sir.

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(1202) Q. (By Mr. Michael): Mr. Pioch, on your direct examination you said something about the addition of a straightening operation for the Walcott machine? A. That is right.

Q. I didn't just get clear what your reason was, why that addition was necessary? A. Well, I gave my reason as that the shaft had to be straightened so the tools of the lathe would take a more even cut, whereas on the shaper that was not so necessary, because our tools were more rigid and another thing, a planer tool and a shaper tool will take a heavier cut than a lathe tool will, conditions being equal.

Q. Well, what was there in the operation preceding the turning or shaping that made it necessary to straighten; what was it that made the shaft crooked, in other words? A. Oh, you get distortion when the shaft cools off in the forging. You get some distortion when it cools. It doesn't stay straight.

Q. So then you straighten it? A. Yes, sir.

(1203) Q. Didn't you straighten with a shaper operation after the forging cooled? A. Yes, we straightened, but there are in some pieces, cases where we straightened the piece maybe four or five times before you finished, and those straightening operations are always to help the machining operations.

Q. Well, now, as I understand it, you have got a forging coming out, is being cooled, after it is cooled you straighten and you do that both to the shaper and the Walcott machine? A. Yes, sir.

Q. What is your addition, then? A. Well, in handling the stock, the work, if the same work that I center this shaft—

Q. Yes. A. For both operations and then we re-center again and then we might re-center the third time. The same way with the straightening operation. We straighten after the forging, we straighten before certain machining operations. We go along and do some more operations, this piece goes out of shape, you take metal out, it springs out of shape, and you have to re-straighten it.

Q. I am trying to find out what there was in the operations preceding the turning or shaping that necessitated the straightening, outside of this cooling off of the forging? A. Well, they must have found out that the shaft went out of shape enough so that it needed another straightening operation.

Q. Do you have any personal knowledge of that? A. Only as I stated yesterday, that I knew that they had to add another straightening operation.

Q. How do you know that? **(1204)** A. Well, just from knowing it.

Q. How do you know it? Did somebody tell you? A. No, it was added in the department.

Q. In what department? In the cam shaft department? How do you know that? Did you add it? A. I saw it.

Q. You saw them straighten it? A. The shop added it. I did not add it.

Q. I mean were they straightened after the forging cooled off? A. Yes, there is a straightening operation, always was there.

Q. Yes. Was there any other? A. Yes.

Q. Where was that? A. Before the turning of the cams.

Q. But you know they didn't do that with the shaper? A. No, sir.

Q. Now, why did they do it, do you know why they did it on the Walcott machines? What occasioned the straightening on the Walcott machines? A. So the tools would stand up longer.

Q. Was the shaft crooked when it got to the Walcott machine? A. They wouldn't have added the operation if it hadn't been.

Q. What made it crooked? A. The machining of the metal before that, the operation before that.

Q. Did you follow the same practice when you used the shaper? A. I don't think so.

Q. Then the shaft was crooked when it went into the shaper? **(1205)** A. Yes, sir. It must have been the same amount.

Q. The same amount of crookedness? A. It must have been.

Q. And in the shaper, how would that be taken care of? A. Well, the action is not the same.

Q. That is true, but how would the action in the shaper take care of the crooked shaft, wouldn't there be any distortion? A. Well, there was another reason there, that when the tools come down they straightened the shaft automatically, that is, the pressure of the cut in the shaper.

Q. How about between bearings? A. Of course, the shaper had, the shaper had enough extra bearings on it.

Q. Three steady rests? A. Yes, steady rests.

Q. You are positive of that? A. It shows on our print.

Q. I will get to that in a minute. You are sure, though, you saw the shapers work? A. Yes, sir.

Q. You know they had three steady rests on them? A. I know that they were on there, yes, must have been.

Q. You know that from memory of seeing the machines? A. No, I know that just as well as I know they must have had a motor to run it.

Q. You are just assuming they were on there? A. No, sir.

Q. Do you know they were on? A. Sure, I do.

(1206) Q. From what do you say that? A. From the drawings.

Q. You are not saying that from seeing the machines? A. I don't remember. That is too far back. I wouldn't remember every detail, this and that, that was on that machine. I couldn't swear to that.

Q. Well, was it the fact that there were three steady rests in the shaper; that you were able to machine the shafts in the shaper without straightening? A. That certainly helped it.

Q. Is there any other thing that helped it? A. I don't know. I wouldn't say so.

Q. Let us assume we put three steady rests in the Walcott machine, would that have avoided straightening? A. That would have improved it.

Q. Would it avoid it to the same extent as in the shaper? A. Very likely.

Q. Your department was never consulted about this requirement for straightening? A. No, sir.

Q. Who was responsible for it, do you know? A. I couldn't say. I believe that idea originated in the shop. I couldn't say. There are many cases where the shop men had an improvement on an operation that we were not notified about.

Q. Would there have been any difficulty in adding two more steady rests in the Walcott machine? A. Well, I couldn't say. Very likely it could have been done.

Q. It would have been very simple, wouldn't it, just as simple as **(1207)** in the shaper? A. I don't know. I think it could be worked out.

The Master: Is it possible that your standards of production were higher in 1924 and 1925 than they had been in the preceding period when the shaper was used, which prompted the production department to add this straightening operation, or would you know as to that?

A. The standards of production? I would say they have been improved from year to year, like adding an operation, we will say, in order to improve the product.

The Master: Do you know of other cases where operations have been added?

A. We improve the quality of the work.

The Master: Do you know of other cases where operations have been added solely for the purpose of getting a better finished product?

A. Yes.

The Master: Is that common at the Ford plant?

A. Where we have trouble. You take on our valve holes in the cylinder block, we finish that hole with 7 different operations.

In other words, we go in there and take a certain amount of metal out roughly with a drill, and then we go in

there with a reamer, and then we go in there with a bore tool two or three times, and finally cut it with a single high-speed tool.

The Master: It is perfectly possible the shapers were started out in 1925 and ran down to 1930, and then the company decided to change it, but at first one straightening operation subsequent to the forging was sufficient in the early days, and **(1208)** then they thought they ought to install some more straightening operations, to get a better product?

A. To increase the production.

The Master: Not to increase production?

A. But to increase the production off the machine.

The Master: I suppose.

A. If they had added one straightening operation, that might have increased the efficiency of the machine, that is, the tool wouldn't have to take off so much.

The Master: It might have cut down a little time on the tool changes?

A. Yes, it would have cut down the time.

The Master: You might have gotten a better result by cutting down the grinding time less and also it would result in fewer shafts being scrapped?

A. That is right.

The Master: And also would have resulted in a better product which would have satisfied the consumers of the Ford automobile?

A. That is right.

The Master: To a greater extent than before?

A. Yes, sir.

The Master: Go ahead, Mr. Michael.

Q. It is true, isn't it, Mr. Pioch, that your tolerances on the A production were much more rigid than on the T production? A. Yes, sir.

Q. Did you know that the Walcott Lathe Company furnished these machines with more than one steady rest? A. No, I didn't know that.

(1209) Q. Just for the record, I call your attention to Exhibit 41, page 1015 of Volume III, and will ask you how many steady rests you see there? A. I don't see any. I don't see any on here, the photograph is so bad.

Q. Do you know what these are here that I point to, these four devices along the front of the machine? A. Is that a Ford shaft?

Q. I don't think so. A. I don't think so, either.

Q. But do you recognize those? A. That is somebody else's stamp there.

Q. That is quite right. A. Yes, I know what they are. They are steady rests.

Q. How many are there? A. There are four of them there. That is to take care of the design of the shaft. That was designed around the work piece again. If we had four bearings on our shaft, we would have had four steady rests.

Q. Couldn't you use a steady rest between cams without having a bearing? A. Yes, sir.

Q. Where did you get your instructions to develop a shaper for the turning of the A shaft? A. A shaper for turning?

Q. A shaper for shaping the A shaft? A. For shaping the A shaft?

Q. Yes. A. I didn't shape any A shaft.

(1210) Q. I understand that. But you recently designed a machine that you say you might have used? A. Just recently?

Q. Yes. A. Oh, I got that from Mr. Farley.

Q. And that was 6 or 9 months ago? A. I believe somewhere in there, yes, sir.

Q. What were the nature of the instructions? A. He came up and asked me if it would be possible to see what I could do to design an attachment onto the shaper that would machine all these cams at one time.

Q. Did Mr. Farley suggest how to do it? A. I told him after looking at the drawing I think I told him right away, I think that is possible. I will get the drawings out and we will look at it.

Q. Did he say an attachment when he talked to you, or was that your idea? A. Well, I think he said attachment, because it would have to be an attachment.

Q. You couldn't do it in any other way than by the use of an attachment? A. Yes, we could have re-designed. If you want me to say this, I think we could design a shaper that would beat the Pioch milling machine and the Walcott machine and everything else that has ever been done before.

Q. With your present knowledge? A. Yes, sir.

Q. You could even beat the Westinghouse? **(1211)** A. I believe so. I wouldn't guarantee the same finish as we get off the milling machine, but so far as production is concerned, I think I could do it with our present knowledge and experience that we have had.

Q. What did you do about the matter of this shaper after Mr. Farley talked to you? A. Well, I gave that job to a man by the name of Boesen.

Q. What did you tell him? A. Well, he is another foreman in the department.

Q. What did you tell him? A. I told him to get the shaper drawings out, that is, the assemblies, and we discussed the thing, and I believe it was his suggestion as to how we are doing it, that we finally hit onto it. It is ideas you have. One suggests this and another suggests that, and it builds it up. That is usually the procedure.

Q. Usually you make lots of sketches while you are talking? A. Yes, sir.

Q. This wooden model here in the courtroom is all the further the thing has progressed? A. That is correct.

Q. You never tried it out? A. No, sir.

Q. Well, tell us, will you, by reference to this wooden model just how these tools work? A. Yes, sir.

Q. The wooden model I refer to is Exhibit 256? A. Oh, this one?

(1212) Q. Yes. A. Well, we will take the upper head, numbering these cams from the front, from the flanged end of the cam shaft, is tool number 2, 3, 4, 6, 7 and 8.

They are controlled to machine the pear-shaped cam from a master cam that is driven off from the machine above.

And as the work piece is driven off from another shaft, it gives it a rotary motion.

The work piece is held in a slide that travels to and fro past the tool.

The tool movement 1 and 5 follows, rather generates the pear-shaped cam again by another master cam shaft that has been added and driven from the machine, and that is also carried—these tools are carried on a slide that travelled to and fro and make their respective cut on the work as the work piece travels to and fro, tools number 1 and 5 are travelling to and fro, but with a speed twice that of the work piece. I think that will explain it.

Q. Do you think you would have any trouble loading and unloading that machine? A. Well, I don't think so.

Q. You have got 6 tools, have you, coming down from the top? A. On the top.

Q. Two from the front and three steady rests? A. That is right.

The Master: How did the operator load that machine?

A. Well, this here, your Honor, would be on a carriage that would pull.

(1213) The Master: Pointing to the front attachment?

A. The front attachment, would pull back.

Q. By hand? A. No.

Q. You would have to turn a wheel or something to run it back? A. I could fix this model here to show that.

Q. I don't doubt that? A. Yes, sir. I mean I could build the machine that way, too.

Q. But you would have to turn this attachment back before you loaded the machine? A. Oh, yes, you would have to slide back, yes, sir.

The Master: I was going to say the loading would take some extra time over the loading of the original shapers used on the Model T, because of the sliding back operation?

A. Because of the sliding back operation?

The Master: Yes, it would take more time to load Exhibit 256 than it would Exhibit 237?

A. Yes, I would say maybe two seconds. That is an approximation.

Q. Isn't there also a delay due to the fact that these tools have, after they feed across the cam, I am speaking of the two tools in the front, have to move back again before you move this thing back? A. No.

Q. How does that work, how would that work? A. You mean it takes more time now than it did before?

Q. Well, the tools before were stationary? A. That is right.

Q. You did not have to await any tool movement before you loaded **(1214)** the machine? A. Yes.

Q. You just finished a cut and took the thing out? A. That is right.

Q. But here what would happen after you finished the cut? A. It would slide back.

Q. While the tools were being drawn to the right? A. After the work is done.

Q. Yes, but where are the tools when the work is cut? A. They would stop here.

Q. Then these forward tools on the attachment would have to move to the right after they took the cut before you moved the carriage back? A. That is right.

Q. That would take time, too, wouldn't it? A. That is what I said. That would be, say, it would take two seconds to slide that back.

The Master: Mr. Michael is not talking about removing the work piece. You are talking now about the movement of the tools after one cut of the machine to get ready for the next cut on the same cam shaft?

A. Yes.

The Master: Did you understand?

A. I understood that.

The Master: Well, would you have this whole attachment sliding back?

A. Yes.

The Master: And sliding over?

(1215) A. Just sliding back here, say about three inches.

The Master: Sliding back alone wouldn't get the horizontal tools in position for the next cut, would it?

A. No, you put the piece in and then start the machine and it would slide in and then start going back and forth.

The Master: All right. After you put the piece in and you started the cutting motion, the attachment, the horizontal attachment would slide first to the left to make the first cut?

A. Yes.

The Master: And after the first cut was completed the shaft would revolve a little bit to prepare the work piece for the next cut?

A. Yes, sir.

The Master: And to get the horizontal tools in position for the next cut, would the attachment then slide out?

A. After it had finished the cam, yes.

The Master: Not after it had finished the cam, but after it had finished one cut?

A. No.

The Master: The attachment wouldn't slide out at all?

A. No, sir; that attachment stays in place until it finishes the whole cam. You see, the motion here.

The Master: I think that was the problem?

A. Oh, I see. No, you would not have to move that back.

Q. That was one problem? A. You wouldn't have to do that.

Q. However, after you finish a cam, the tool is over here? A. Yes, sir.

(1216) Q. Over to the left? A. Right there.

Q. When you finish it it is over to the left of your cam? A. Yes. I understand now.

Q. Now, what happens? Don't you have to wait until the tool goes back on the idle stroke before you pull the attachment in? A. Yes. Now, it is ready for the next cam shaft.

Q. After you pull the attachment back? A. Yes.

The Master: Is that an extra operation necessitating a longer time than without the attachment?

A. That would take an extra two seconds, you mean to get this out of the way?

Q. Not only that, but also get the tool back in? A. That isn't extra time.

Q. None of this was in the shaper as you used it? A. No, but this was.

Q. Those tools are stationary? A. Yes, and this is in the position as it was in that machine right there, that is, the work piece.

Q. Yes, but you had no movement of an attachment of tools? A. No, but watch this here now. That shaper there did not stop in that position. It stopped in this position.

The Master: As the mechanism swings back?

A. There is no extra time there.

Q. No extra time there? A. No, sir. Don't you see that? I see what you mean. You mean if the machine would have stopped at this position on the original (1217) cam shaper. It didn't. It stopped back here, so there is no extra time there.

The Master: As you complete one cut on either shaper and get ready for the next cut, you have to have, well, a non-cutting stroke of the shaper to bring it back to the starting point?

A. Yes.

The Master: Because it wouldn't cut on the return stroke?

A. No, sir.

The Master: Now, with your re-designed machine you have to have the vertical tools moved back as they did before to get ready for the next cut, and you also have to have the horizontal tools moved back?

A. Yes, sir.

The Master: Does that increase the time of operation?

A. No, sir; it does not, because the added tool is in the same position as the tools that are in the upper head.

The Master: It moves back at the same time as the upper tools do?

A. That is right. As the work piece carrier carries back—we will say it is over here. That tool has finished its cut. We will say that is the last stroke on that machine, I mean the last cut across there. Then the machine has to come back over here for the next piece, so this did not add any more time to the machine, this movement.

Mr. Farley: Let the record show when the witness said on that machine, he pointed to the Model T cam shaper, Exhibit 237.

A. Yes.

(1218) Q. (By Mr. Michael): Did the tools in the shaper as used at the Ford plant raise up away from the work when the work moved back for another cut? A. On every cut?

Q. Yes. A. Oh, yes. The whole head moved back, just, say about two or three thousandths, just enough to clear the work.

Q. And then also you had this part. A. There was a hand wheel out here that you could raise this whole head up.

Q. Those details aren't on this wooden model? A. No, but it shows it on the prints.

Q. You had to provide something in the attachment for withdrawing the tools on the return stroke? A. Yes.

Q. That is not shown in this wooden model? A. No. On this attachment, if we built a shaper like this, we would duplicate the same mechanism that we have got on this head here for moving the tools back on one cut a couple thousands, the same as they do on the upper head.

The Master: With your attachment, you have a movement of the tools the same way you do as with the original shaper, except it is twice the speed of the original shaper, because it is moving in the opposite direction?

A. That is right.

Q. In the original shaper, the tools don't move at all.

The Master: I beg your pardon?

Mr. Michael: The work piece.

The Master: Opposite direction of the movement of the **(1219)** work piece?

A. That is right.

The Master: What you really have here with the attachment is a combination of both a planer and a shaper?

A. Yes, sir.

The Master: As I understand the two forms of tools?

A. Yes, sir.

Q. As I understood, these horizontal tools actually chase the work, finally overtake it and finally overrun it? A. Yes, sir.

Q. Did you ever see that in a shaper before? A. No, sir. You see, in a regular shaper your work is stationary and the tool moves across the work.

Q. Yes. A. In this case, like the Master pointed out, this is a combination of a planer and a shaper. The upper head is the planer part, representing the planer part and the lower head is representing a shaper. In a shaper the tool moves. This is moving, and in a planer the work moves and the tool is stationary. That is the upper head.

Q. Where did you get this idea of making the tools chase the work? A. I believe that was Boesen's idea.

Q. You didn't suggest that? A. No, sir.

Q. It never occurred to you? A. Well, no, I would give him all the credit for that.

Q. It is somewhat similar to these horse-race machines, isn't it, where you put a nickel in the slot and one horse is ahead and **(1220)** finally another overtakes it? A. Yes.

Q. That wouldn't be a bad name for the patent, horse-race patent? A. I think that is very clever myself.

Q. Wouldn't that be a good name for it? A. I don't know.

Q. It is rather descriptive, don't you think? A. I wouldn't want to give it a name.

The Master: You do have a somewhat more complicated situation with this re-designed tool than you had with the first; you have more parts?

A. Oh, yes. This would all be additional. That is obvious.

The Master: It would probably get out of order more often?

A. Where you have more moving parts you have more trouble. That always runs hand in hand.

The Master: That attachment, as you operate it, is in synchronism with the driving mechanism in the main part of the machine?

A. As I said before there, if we had to design a new shaper I wouldn't design it like this. We only show what could be done if we had the shapers at that time and had been forced to use them. We would have had more trouble with those. I can't see anything else but that, because you have more moving parts. You have got all that mechanism that is wearing.

The Master: Would you have more trouble with the tools themselves breaking? Is there any more pressure on the tools that might cause difficulty there?

A. I don't believe so.

(1221) Q. Hadn't you this difficulty in this model, Exhibit 256— A. Yes.

Q. You have six tools bearing down on the top of the shaft? A. Yes.

Q. The pressure is considerable, isn't it? A. Yes, it is.

Q. You have only two tools coming in from the front? A. Yes, sir.

Q. Those relative pressures are very unequal, aren't they? A. Yes, sir.

Q. Wouldn't there be some difficulty in the cutting operation due to that? A. No. We have got our steady rest.

Mr. Farley: Just a minute, Mr. Pioch. Suppose you get a piece of clear paper and make a sketch on that.

A. All right. We will call that our steady rest here.

The Master: Mark that S.

Q. As you have drawn this slot in here it is much too high, the way it was? A. It doesn't have to be that high.

Q. This steady rest here doesn't even come up to the center line of the shaft? A. That is right. Thanks. It doesn't have to come any higher anyway.

Q. It has to come up at least to the center of the work piece? A. That is right. I show a clearance there. Now, here we have the six tools, have we not?

Q. Yes. Just mark that top tool, six top tools. **(1222)** A. Six?

Q. Yes. A. Six top tools, and we will represent the six top tools with six inches, is that all right? I mean as a line of force. Now, we have two tools in that direction, two front in that direction. We will represent them by a line two inches long.

Q. These are the six top tools? A. Yes, these are the six top tools. And we will say each tool—well, any amount of pressure you want on each tool, assume 100 pounds on each. This would be units. That is a good description. Units for six top tools. Units for six.

Q. Tools? A. Top tools. Now, then, these tools represent a force in this direction and those represent a force in this direction.

The Master: As shown by the arrows?

A. Yes, sir. Now, then, the resultant would be on our steady rest in that direction.

The Master: Now, you are showing what?

A. I am showing a graphic diagram.

The Master: For the sake of the record the resultant force which you have indicated is on the hypotenuse.

A. Of the right angle triangle. Now, if we come back and duplicate that same angle on to the steady rest, is that about right? Parallel?

The Master: That is near enough.

A. That is near enough. What do we get? We get that force moving originally from a horizontal plane to a diagonal plane, what we call the tangent, an angle whose tangent is .3333. That is **(1223)** changed from this point

on the steady rest to a point over there. You can see how very small that would be.

Q. Mark the first point A and the second one B. A. First point A and second point B. Now, this point is only moved on our diagram about 1/8th of an inch from the center line.

Mr. Farley: Refer to the point.

A. Point A is moved from the horizontal center to point B one-eighth of an inch from A, approximately.

Mr. Farley: Correction there. You said horizontal. You meant vertical?

A. Vertical, yes. So you can see it wouldn't make much difference as far as changing conditions of the steady rest.

The Master: There would be some tendency of these two front tools to spring the work piece to the right in your drawing?

A. No, your Honor—yes, you have this much front end thrust, but the resultant thrust is here.

The Master: Yes, but so far as the front tools, wouldn't those spring the work piece?

Mr. Farley: Rearwardly.

The Master: Toward the rear. There is a tendency to put a pressure on the side of the vertical tools, making an additional pressure to the pressure which you have as the tools cut on the Model T cam shaper, which pressure was only upward and backward?

A. That is right.

The Master: And these tools are not designed to be resistant to a lateral or side pressure, are they? They would move **(1224)** more readily as against an equivalent amount of side pressure as against backward or upward pressure?

A. I don't know whether I understand. These tools here don't affect the cutting tools here.

Mr. Farley: I think I know what the Court has in mind. Mr. Quaife has in mind the proposition that your shaper tool in cutting is making the cut on the side, that is, they are side cutting it?

A. Yes.

Mr. Farley: For your point of the tool making it cut, and then this side edge here doing the cutting, assuming your shafts were in that direction.

A. Yes.

Mr. Farley: If you add to the other pressures involved a pressure of cutting force of these tools here—

A. Yes.

Mr. Farley: It is going to complicate matters by the cut that you would be taking at the side edge.

The Master: Yes. I didn't know the shaper tools were cutting on the side.

A. They do, so that wouldn't affect the upper tools at all, these added tools wouldn't affect that.

Q. (By Mr. Michael): These tools you have in this wooden model are only representative, they are not shaped like the real shaper. A. This is their shape.

Q. Set in diamond fashion? A. That is right. They were made—this part? It exactly represents the tools.

(1225) Mr. Farley: With a little side rake on them in this direction?

A. Yes. Shall we use this sketch?

Mr. Farley: I offer this sketch as Exhibit 263.

(The sketch was marked Exhibit 263.)

The Master: It is admitted.

A. I didn't measure the length of that resultant line. Six and one-fourth units. I want to make sure you understand this here. If you had six inches here, that six inches—

The Master: You mean 600 pounds?

A. In a vertical pressure, that addition of the two front tools would have moved that force, we will say, to the right, to the back of the machine, at the angle I gave there of tangent .3333, and that 600 pounds would have been this angle in this direction. We will call it 630 pounds. 6.3 units is the resultant.

The Master: That is it approximately?

A. Yes. Somebody might figure that out.

The Master: Suppose we take a brief recess.

(Recess.)

Q. (By Mr. Michael): For the record, I want to just bring out, if we can, what has been added to this horse-race machine. I am not using that in any funny way. I like it as a descriptive term, as compared to the old shaper. As I understand your testimony you have added this whole table that overhangs the front of the machine? A. Yes.

Q. And you have added the tool holders carried by that table? A. Yes, sir.

Q. And you have added the shaft and the master cams for moving **(1226)** those tools in and out? A. Yes, sir.

Q. You have added the mechanism for moving the whole table in and out? A. Yes, sir.

Q. The mechanism for moving the table longitudinally of the shaft? A. Yes, sir.

Q. And you have added the gears for synchronizing the revolution of the master cam with the—in the attachment, with the revolution of the master cam in the machine proper? A. Correct.

Q. And you have added the mechanism for moving the—that is, you have added the mechanism for moving the carriage, the tool carriage of the attachment longitudinally of the machine? A. Yes. I believe you stated that once.

Q. In addition to that are there any things that you added as compared to the old shaper? A. No, sir.

Q. And you have never done this before? A. No, sir.

Q. And you have never tried it out? A. No, sir.

Q. And you know nothing in the prior art that supports or lays the basis for any such thing as this? A. No, sir.

Q. Mr. Pioch, why, or at whose suggestion did you use the particular drawings or blueprints, Exhibits 254 and 255, on which you show this horse-race machine? **(1227)** A. This is not a machine. This is an attachment.

Q. Well, attachment? A. Yes, sir. Whose suggestion?

Q. Why do you show it on this particular drawing? A. This is the first sketch and we made it on this drawing to eliminate the time necessary to make such a drawing.

Q. Do you know when the old Ford shapers first went into use? A. Yes.

Q. What year? A. 1913.

Q. What is the date of this drawing? You are sure it was 1913? It was not 1914? A. Well, if I can look in my notes I can tell you exactly.

Q. All right. I wish you would do that. A. The first cam shaper went on production on October 28, 1915, not 1913 or 1914, but 1915.

Q. 1915? A. Yes, sir.

Q. What is the date of this drawing, Exhibit 254, also Exhibit 255? A. Exhibit 254 is 11-17-1913, and Exhibit 255 is dated 11, looks like 17-1913.

Q. The same date? A. The same date.

Q. And both of them are marked obsolete, aren't they? A. Correct.

Q. What does that mean? A. That means it has been put out of use.

(1228) Q. Means the attachment has been? A. The machine.

Q. It doesn't mean the drawings are obsolete? A. The drawings are put out of use also.

Q. Do you know when these particular drawings became obsolete? A. I believe our tool card will show that date. I can get that off the record. No, I mean the Z number card. The 18-Z-3 card would show the date.

Q. When these drawings were obsoleted? A. Yes, sir.

Q. Have you got that record here? A. I don't believe I have. I can produce it. Will you make a note of that, Mr. Farley? I want the 18-Z card.

Mr. Farley: 18-Z-3 card, isn't it?

A. Yes, sir.

Mr. Michael: Maybe I can clear that up.

Q. These are copies? A. I don't have a note of it here.

Q. These are copies of two Ford drawings placed in evidence at the trial before Judge Tuttle? A. Evidently.

Q. One is marked Exhibit 62 and the other is marked Exhibit 63. Now, will that help you in connection with this matter? A. No.

Q. Aren't those drawings of the Ford shaper? A. Yes, sir.

Q. And what are the dates of those drawings? A. This one marked Exhibit 63 is dated 4-26-1915.

(1229) Q. What is the date? A. 4-26-1915.

Q. Yes. And what is the date of the other, Exhibit 62? A. 5-18-1915.

Q. What does that mean to you, if anything, those dates on drawings Exhibit 62 and Exhibit 63, with reference to the dates on these two drawings, Exhibits 255 and 254? A. That means there had been another drawing made after this. These exhibits are not exact duplicates of the ones dated 11-17-1913.

Q. No. But they are similar views of the machine, aren't they? A. That is all.

Q. Corresponding views? A. Yes, sir.

Q. And the fact there was this later set of drawings would indicate that these earlier drawings, Exhibits 255 and 254, were at least on the date of the new drawings obsoleted? A. Yes, sir.

Q. And replaced by these new drawings, Exhibits 62 and 63? A. That is correct. That is general procedure in the department; nothing unusual about that.

Q. Well, if you will notice or compare roughly these corresponding drawings, you will note a number of changes in them, will you not? A. Yes, sir. That is possible.

Q. So that the changes no doubt occasioned the new set of drawings? A. That is right.

Q. And this new set of drawings comprises a total of 140 sheets, isn't that right? (1230) A. That is correct. I can't see the number of sheets on here. Oh, here. This will probably explain. That is 18-Z-3, dated 11-17-1913.

Q. That is Exhibits 254 and 255? A. Yes, sir; Exhibits 254 and 255 show a total of some 58, we will call it 58 sheets. Then 18-Z-3 dated 4-26-1915, Exhibit 63 and Exhibit 62, dated 5-18-1915, show a total number of sheets of 140.

Q. Now, you have said, have you not, that the first shaper went into use in 1915? A. That is correct.

Q. From which set of drawings was that shaper made? A. I believe from both. I don't remember.

The Master: Where the two drawings are different and where you have provision for differences in

one, the shaper has to be designed from one or the other. It can't be made from both.

A. It can be made from both. That has happened. You see, your Honor, very likely here is what happened. When this design was started, it was started with these Exhibits 254 and 255 and after it was completed in the drawing room, the tool room started to build this machine, and as they went along the machine was probably 75 percent completed and new ideas were put into effect, additions made and new drawings made, representing the Exhibits 63 and 62.

The Master: Well, the machine as actually constructed would be more likely to follow exhibits—

A. The finished machine would follow the Exhibits 62 and 63.

(1231) Mr. Farley: I wonder if I might at this time call the attention of the Court to Exhibit 246-A, which shows a permanent inventory card for the first shaper. Are you familiar with those?

A. Yes, I have seen them.

Mr. Farley: I wonder if I might be permitted to show the card to the witness?

Mr. Michael: Yes.

Mr. Farley: Does that show the date when the machine first went into use?

A. B-X-3, that is our production department. That shows the date October 26, 1914.

Mr. Farley: From what record did you make that note of 1915, of the machines first going into use? Did you consult the permanent inventory record?

A. No, I didn't.

Mr. Farley: What have you got to say now as to the date when the machine was first put into use?

A. I believe I got the date off this card here.

The Master: This is Exhibit 248?

A. 248.

The Master: Which is a list that was presented by Mr. Herklotz showing the date that the various cam shapers were acquired?

A. 10-28-1915. That corresponds with my note.

Q. Where did you get your note, Mr. Pioch? A. I don't remember. Very likely from this exhibit here.

The Master: Exhibit 248?

(1232) A. Exhibit 248.

Mr. Farley: That list is subject to correction if error should appear.

The Master: That is true. It apparently is not correct in this respect.

Q. (By Mr. Michael): Getting back to these drawings, Mr. Pioch, wouldn't it be true that anything that was used and is shown in the earlier drawings, Exhibits 254 and 255, would have been carried forward into the second set of drawings? A. That is right.

Q. So that any machine constructed after this date, 5-18-1915, would have been made in accordance with the drawings, Exhibits 62 and 63? A. That is right.

The Master: How many steady rests are shown on the drawings, Exhibits 62 and 63?

A. Exhibits 62 and 63? It shows one.

Q. And Exhibits 254 and 255 show how many? A. Three.

Q. Are you sure that the tools were stationary in the shaper as used in the Ford plant, I mean stationary lengthwise in the machine? A. Yes, sir.

Q. You are positive? A. They moved in a vertical position. They were not stationary.

Q. The work was under the tools? A. Correct.

Q. The tools did not move across the work? (1233) A. No, sir.

Q. Do you know Mr. Kindall? Did you know him? A. I had a Kendall working for me.

Q. E. W. Kindall? A. I don't remember his initials.

Q. K-i-n-d-a-l-l? A. Oh, no. I know Kendall, K-e-n-d-a-l-l.

Q. Do you know Mr. Oberhoffken? A. Yes, sir.

Q. Who was he? A. He was a foreman in the drafting room. He was a draftsman, first, like myself, and then he became a foreman.

Q. Did he have anything to do with the design of the shaper? A. I believe he did. He directed the designing of it. The man that designed this machine was a man by the name of Olaf Anderson. He designed the machine.

Mr. Farley: He made the drawings?

A. He made the design and some of the drawings.

Mr. Farley: Under Oberhoffen's direction?

A. Yes, sir.

Mr. Farley: Is Anderson alive?

A. He is dead. Sorry. I might state that he was a very brilliant designer.

Q. (By Mr. Michael): Mr. Anderson? A. Yes, sir.

Q. Now, at the trial before Judge Tuttle, the defendant introduced in evidence an exhibit marked 61, which was in the form of an affidavit attached to these two drawings? A. Yes.

(1234) Q. Exhibits 62 and 63. And I show you a copy of that affidavit and will ask you if you disagree with the substance of it. It was signed, I think, in 1920? A. Do these letters on here refer to these.

Q. The letters show on these prints, on Exhibits 62 and 63. Here is one here. They are put in very light. Here is D. B. Here is G and here is H. Don't you see it there? A. No.

The Master: What are you looking for?

A. Letter G and letter H.

Q. See the H there and the light line going down? Here is the G here. Mr. Farley, have you the originals of these?

Mr. Farley: I think they are over in the office.

The Master: I think it is a G and H, with a fine line. It is very dim.

Mr. Michael: They are Mr. Farley's exhibits. These are just copies. The lettering would show up decidedly on the originals.

Mr. Farley: I have got all the original exhibits over in the office. We will produce those.

The Master: It is very certain that there is an H.

A. Some kind of letter there.

The Master: It is H. I have a very good pair of eyes.

A. We will assume that is G and H there. I see B here.

Q. Yes. A. I see C. That is right. Okay. Well, we will assume that is G and H. That certainly is a confusing description of this.

Q. Well, do you want to make changes in it? A. No, I can't make any changes in that. To me, the description **(1235)** of the operation of that machine is confusing. It couldn't work that way.

Mr. Spohn: You refer to Exhibit 61.

A. Exhibit 61. What I think he meant here when he says it is a cutter to move from left to right, he should have added, "Across the work piece." They did not move. I imagine he meant the cutters did the work from left to right.

The Master: Relatively, I suppose?

A. Yes. That is a poor description of the operation of the machine. I don't know who this Kindall is.

Q. Would your records show whether he was ever in your department? A. Yes, sir.

Q. Will you look at your records, Mr. Pioch, and tell us who I. W. Kindall was, if your records show anything about it? A. Yes.

Q. Can you identify that photograph, Exhibit 52? A. Yes, sir.

Q. What is it? A. It is a cam shaft shaper.

Q. Well, now, photograph Exhibit 52 you said shows a Ford cam shaper? A. Yes, sir.

Q. And how many steady rests do you see in that machine? A. One.

Q. Can you tell by looking at these drawings, Exhibits 62 and 63, how long they remained current? A. No, sir.

Q. Well, suppose you find on these drawings, Exhibits 62 and 63, **(1236)** dates of changes as recent as 1919, would

you say that the drawings were still in effect at that time? A. Yes, sir. Evidently that shows there were some additions or changes made. It says on here the record shows under the column marked changes re-drawn by W. S. 5-22-1919. The next record under this column shows details 196 and 197 added by W. S. 7-8-1919. The next record under the change column shows sheet numbers of pattern QQQ corrected by W. B. dated 8-9-1919, and I might state if this shaper was still on production that you would find changes on our drawings marked as late as last week.

Q. So these notations you have just read from Exhibit 62 indicate under your practice in your department that these drawings were still in effect in 1919? A. That is correct.

Q. Do you recognize this photograph I show you, Exhibit 53? A. Yes, sir.

Q. What is it? A. That is a Ford cam shaper.

Q. Does it look like the same machine as shown in the other photograph, Exhibit 52, or can you tell if they are two different photographs of the same machine, or are they different machines? A. It might be different.

Q. Well, I wish you would compare them and express an opinion on it. A. They look very similar.

Q. Do you think they might be the same machine? A. They might be. Of course, there was more than one machine built, so this might be the same machine and might not.

(1237) Q. How many steady rests do you find in Exhibit 63? A. So far as I can see only one.

Q. And you only find one in Exhibit 52? A. That is right.

Q. Is this the brass tag here on the front of the master cam housing? A. Yes, sir.

Q. Same on each machine? A. Yes, sir.

Q. Do you suppose a magnifying glass would bring out the number? A. Yes, sir.

Q. You don't happen to have one here? A. I am sorry, I left mine home.

The Master: This is 7069 and this is 7836, so they are different machines. 7089.

Mr. Spohn: Mr. Watts ought to make a statement on that. He looked at them last night.

Mr. Watts: I checked them up with a magnifying glass and they are both 7089.

A. Both the same?

Mr. Watts: Same brass tag number.

A. They must be the same machine then.

Mr. Michael: 7089.

The Master: It is pretty clear.

Mr. Michael: You can make that out?

The Master: Yes. I can.

Mr. Spohn: On Exhibit 248 it shows a brass tag number of 7089.

A. That would very likely verify it.

(1238) The Master: Yes.

Q. You mean as the first cam shaper put into use? A. Yes, sir; so that must be the one and same machine.

Q. Can you explain to me now why you selected these obsolete drawings for the building of your attachment as distinguished from these drawings, Exhibits 63 and 62? A. No. The only reason is that these obsolete drawings that I have here as Exhibits 254 and 255 were in our files, and Exhibits 62 and 63, the originals, must have been with Mr. Farley.

Mr. Farley: I think I can explain that. You have no objection, have you, Mr. Michael?

Mr. Michael: I have no objection.

Mr. Farley: We procured and we still have it over in the office, a small, brown manilla folder which apparently was kept in some department that had to do with new machines or inventions, or something of that kind, and it had this typewritten statement of Kindall's, and blueprints from which these photostats were made. I don't know whether you have prints of these in your files or not.

A. I was surprised to see that.

Mr. Farley: I was surprised that you had other drawings different from those.

Mr. Michael: Well, the witness says you had drawings, Mr. Farley.

Mr. Farley: We had these drawings, Exhibits 62 and 63, but I did not have the drawings, Exhibits 254 and 255. They came from his department somewhere.

(1239) A. This was added on here.

Mr. Michael: Your Honor, this Exhibit 61, this certificate signed by Mr. Kindall was merely identified below before Judge Tuttle. We have talked about it here, and I am merely asking that it be preserved in that condition until we hear from Mr. Farley as to who Mr. Kindall was, and then I may want to offer it.

The Master: All right.

Mr. Farley: I have no objection.

Mr. Michael: I offer it now under the same exhibit designation as was used below.

The Master: Do you recognize that form of document as being the regular type or form you have at the Ford Motor Company?

A. No, sir.

The Master: Well, I will admit the exhibit in evidence.

Mr. Farley: I will state, if your Honor please, that is a record which I procured and which I have every reason to believe was a regular record of the company, probably some sort of record made by someone who might have been handling patent affairs for the company at that time, in May, 1920. I rather imagine that was in Jack Harness' time. I don't know.

The Master: Can you tell from these exhibits in evidence, 62 and 63 and 254 and 255, whether or not according to those drawings, the movement of the tool is merely vertical, or was it longitudinal?

A. Yes.

The Master: And you find from those that it is not longitudinal?

(1240) A. That is correct.

Q. (By Mr. Michael): Well, let me ask you this, Mr. Pioch: If Mr. Kindall ever was in your department or connected in any way with this shaper machine and made this affidavit in May of 1920 and attached these drawings,

Exhibits 62 and 63, would you say that those drawings were still current at that time? A. I believe so.

The Master: I think that is a double-barreled question.

A. If he had been in the department, your Honor.

Q. (By Mr. Michael): Let me clear it up this way: From your own personal knowledge, Mr. Pioch, were drawings, Exhibits 62 and 63, still current at the time you stopped using the shapers? A. Yes, sir.

The Master: Mr. Pioch, you said you didn't make any attempt to particularly keep in touch with the organization of the department similar to yours among your competitors, or other companies which are not competitors?

A. Yes.

The Master: Do you or your department make an effort to keep in touch with the kinds of machines that are being put out to perform different types of work that is done at the Ford Motor Company and also in other companies?

A. Yes, sir.

The Master: You have men who go around inspecting machines?

A. No, we do not. It is not worked that way, your Honor. The method is that the machinery salesmen come and present their new ideas.

(1241) The Master: Suppose there is a machine in a plant which is designed as the cam shaper was by men in the plant itself, and is not on sale, and yet is a very superior type of machine to any other type that is performing the particular work, would that ever come to your attention?

A. You mean if that machine was in another place?

The Master: If it is in another plant that is a manufacturing establishment, and if the company is not interested in selling the machine to anyone else, but simply having it for their own purpose in production, do you make any attempt to ferret out information about such machines?

A. No, sir. We would have to go to this place and look over their equipment to find out whether they had new methods, but if the method was known and called to our attention, then we would try to improve our machinery, that is, operations to increase their efficiency.

The Master: Do you know whether engineers from other plants who are competitors or non-competitors frequently visit the Ford Motor Company to inspect their machines?

A. They do, but they come to see our operations through a request and we show them, and that also happens if we hear of a certain particular improved machine, say, for instance, General Motors or Chrysler's, why then we go over there and look at their machines.

The Master: Do you know whether there were ever any requests with respect to the Ford cam shaper by competitors asking about its design and function?

A. No, I don't.

(1242) The Master: You don't know whether any other company ever made a request?

A. No.

The Master: To make a Ford cam shaper?

A. No.

The Master: Or a machine similar to that for their own purposes?

A. No, sir.

* * * * *

Re-Direct Examination by Mr. Farley.

Q. I don't think this is of very great importance, but when you talked about the way in which you selected your foreman, I was wondering which was the most important factor which would prompt you to select, let us say, Mr. McCoskey or Mr. Boesen as foreman in your department, his ability as a draftsman or his ability to handle men, executive ability? A. I would say that is 50-50.

Q. Now, in connection with various interesting machines that you were questioned about which you had devel-

oped, I was wondering about a certain machine which we saw there at the plant, the machine for testing the cam shafts, where the shafts go in on a conveyor and at the end of the machine they are automatically passed or rejected; is that a machine developed in your department? A. Yes, sir; under my supervision. Along with those inspection machines we developed a machine for a push rod and a machine for **(1243)** the valve inserts, that is, to check the valve inserts.

Q. That push rod machine is another machine that is over there in the cam shaft department in a glass case, I think? A. No, the push rod machine is over in the foundry.

Q. I mean to say the wrist pin? A. The push rod machine is in the foundry building.

Q. But the wrist pin is in the motor building right alongside of the glass room where they have the cam shaft testing? A. Yes, sir.

Q. There is one thing that I didn't ask you on direct examination that escaped my attention at the time, and that is the general proposition as to whether or not as a part of the functioning of your department and in connection with Sheldrick's department, who designs the car, does the question ever arise of Sheldrick's department designing something that you would consider when the details came in, and you would find that there might be some difficulties in machining the part from the standpoint of production difficulties? A. Well, that happens. We consult Mr. Sheldrick and work with him and have him so design these particular parts to eliminate those objections.

Q. Does that happen very often? A. Very often.

Q. Is it a matter of every-day occurrence? A. Well, every week, I will say that comes up.

Q. Do you happen to know why the Model A shaft has larger bearings than the Model T shaft? Do you know what I mean? A. Yes. Why it was designed that way?

(1244) Q. Yes, or the reason for that difference in design? A. Well, it eliminates the extra loose bearing like on the Model T.

Q. In the Model T, the bearings were constructed with what we call a split bearing? A. Yes.

Q. When you put this Model T shaft in the tool Exhibit 34, you put the three bearing parts down into a re-

cessed part something like a steady rest you drew of the cam shaft? A. Yes, sir.

Q. Then you had another bearing crank that went over the top and completed the bearing? A. Yes, sir.

Q. Now, whereas in the Model A, the bearings are— A. (Interposing): Integral with the shaft.

Q. Now, does that in any way change the function or operation of the shaft in the motor? A. No, it does not.

Q. And can you state why the bearings on the Model A shaft are made as large as they are, or let me put the question this way: Is there any particular relationship between the size of the bearings and the size of the cams on the Model A shaft, or any reason for that relationship? A. Well, the bearings for one reason, as I see they have this size, is that the bearing diameter reaches beyond the point of this cam.

Q. That is, the throw of the cam? A. And that is made so as to make the assembly possible.

Q. Make the assembly possible, and by that you mean the insertion of **(1245)** the Model A shaft into the motor? A. That is right.

Q. You understand the idea being that if the bearings are made slightly larger than the distance of the nose of the cam from the center of the shaft that you can then insert the shaft endwise into the motor, using solid bearings instead of the loose bearings? A. Split bearings.

Q. That you used on the Model T? A. Yes.

The Master: Does it make any difference in the efficiency of the operation of the motor as to whether you have large bearings of the type of Model A?

A. I don't believe so. The Model T was not as heavy a motor as the Model A. The horse-power rating shows that and of course this had to be rigid. You can compare the two diameters and see that these are larger in the Model T in the cams themselves and shafts themselves.

Q. Is it your testimony that the chief, if not sole reason, for making the bearings larger on the Model A is not because of any requirements of the motor itself, or the smooth functioning of the motor, but rather because it is simpler? A. Simpler to assemble.

Q. Assembly and production of the machine? A. I will say it is both of those reasons.

The Master: In what respect does it improve the operation of the motor?

A. On account of the fact the bearing pressures were greater on (1246) the Model A than they were on the Model T and required larger bearings, the Model A cam shaft with this size diameter bearing would never stand up. It had to be larger than this. Therefore they made the bearing large enough to go over the point of the cam so that it would cover both reasons.

The Master: I see.

Q. If, for example, Mr. Pioch, the use of the shaper had been, or the necessity for the use of the shaper, if you had been confronted with that in 1927, when you came out with Model A production, and let us assume that you would have considered it impossible, or otherwise, to have built a shaper such as you have shown with the attachment, would it have been possible or feasible to have altered the length of the bearings so as to give ample clearance for the old type shaper to get in behind? A. Yes, it would.

Q. And is that a sort of expedient or device that you adopt around the plant? A. We would have had to take the center bearing and one end bearing and made those two bearings shorter by the distance enough to get a shaper tool in front of the cam.

The Master: About how much shorter would that be, roughly?

A. Those shaper tools were about, we could have made about three-eighths of an inch. That would have made the shaft—that would have made the bearing on the shaft three-sixteenths shorter on the end, and—I will correct that, three-sixteenths. I will say one-fourth of an inch on the end bearing and one-fourth of an inch on the center bearing. Then probably we would have made these bearing diameters a little bit larger to make up for (1247) the loss in bearing surface.

Q. Increased the diameter on them? A. Increased the diameter.

The Master: If you increased the diameter you would have to cut away the bearing even further,

because the tool is slanting upward for clearance, and the higher the bearing, the further back you would have to recess it?

A. To clear the tool, yes, sir.

The Master: That would have been more than one-fourth of an inch if you increased the size of the bearing?

A. It would be a quarter, approximately, one-fourth, but I don't know what the diameter of this is. Approximately one and one-half inches.

Q. Have you made the computation? A. Yes, sir.

Q. And what do you find? A. I find that if we had done that, shortened the bearings one-fourth of an inch, we would have increased the diameters from one and one-half to one—1.714.

Q. And that would have been an increase of 20/100ths of the diameter, and insofar as the inclination of the shaper tool itself, in fact I don't think it would have any effect? A. You would have to cut—

Q. 10/100ths? A. That is right.

Q. Less than 1/10 of an inch? A. That is right.

Mr. Michael: For instance, if your tool, your shaper tool **(1248)** was out here like this, and supported by the tool holder at this point, then what?

A. We would have had to cut that support back 1/10th of an inch.

Q. I don't think the Court understood how the shaper would work under these conditions. It would mean you would provide yourself about, approximately a half inch clearance between the edge and the cam? A. Approximately half an inch.

Q. That would be enough to clear the tool entirely? A. Yes. You see, you would have one cam here and this would be the bearing, and that would be, say, the tool support for the increase in diameter, and this would be the tool backing after the increase in diameter.

Q. And suppose you had been confronted with the problem and decided to solve it by a slight change in design of the cam shaft, would that have required any more time or knowledge or effort on your part than in making the computations which you now just made? A. No, sir.

The Master: Is there any necessity or desirability for the center bearing to be exactly in the center between the end bearings of the cam shaft?

A. No, sir.

The Master: If you cut part of the center bearing off, that would throw it a little off center?

A. Yes, it would.

Q. But that wouldn't be of any serious consequence? A. Oh, no.

Q. Wouldn't affect the operation of the motor? **(1249)** A. No.

Q. Now, let me ask you this, Mr. Pioch: You were in charge of the department when the change was made from Model T to Model A? A. Yes, sir.

Q. Now, during that period do you recall the fact that Model T production was stopped entirely in May, 1927? A. Yes, sir.

Q. And during that period from May, 1927 to December, 1927, was all a period of development of Model A? A. That is right.

Q. And in connection with that particular development your department had a great deal of work to do, did it not? A. It certainly did.

Q. You had a great many machines to modify? A. Yes, sir.

Q. Or re-design? A. Re-design, build new, change.

Q. Build new machines. Now, do you recall whether or not in that period of 7 months or more, there was any occasion at all that you can recall where the very thing we have now been discussing, that is, an alteration of some part or design of the car arose, or whether there were any questions of that type that arose, and for production reasons the design was modified in any respect whatsoever. Were there many or any of those? A. Yes, I can name you one in that period, and that was the valve bushing. That was a chilled cast bearing, and we changed that to a soft cast iron, eliminating the grinding operation.

Q. And were there other instances in that connection that you don't **(1250)** now specifically recall? A. Why, if I had time to think, I might name some more.

Q. Now, let me ask you this question: Suppose you had been confronted with the problem in 1927, when you

changed over to Model T—to Model A, and the proposition had been before you and your production department, that you must either use the old Landis grinders for the production of the millions of the Model A shafts that were to come, or to make a change in the design such as you have just discussed of the cam shaft, what would you have done? A. In that case we would have had to change the cam shaft.

Q. And do you think there was any possibility that you would have gone to the Landis grinders instead of changing the cam shaft? A. I don't believe so, no, sir.

Q. The Master asked you some questions concerning changes in the standards of production on the Model T about 1924. Model T production started when? A. In 1928, I believe.

Q. Model T, the old Model T? A. Model T production started, I believe, in 1909.

Q. 1909 or 1910? A. Somewhere in there.

Q. That continued for 17 years, did it not? A. Until 1927.

Q. And approximately 15 million Model T's were built during that period? A. Correct.

Q. Now, are you in a position to know whether there was any **(1251)** particular change, as far as standardization was concerned, during all of those years of Model T production? A. Why, there were a lot of improvements made from the time we started until the time they stopped the job.

Q. Wasn't there any change that you were aware of insofar as machining tolerances, generally speaking, throughout the Model T production, such as occurred when you made the shift from Model T to Model A? A. The limits of the parts were made smaller when we went into Model A production from what we had on the Model T. That means we had higher standards of quality of work on the Model A production.

Q. During the period of Model T production from 1909 to 1927, were there changes being made in tolerances and standards required for the various parts that went into the automobile? A. There were changes made in tolerances during the Model T production, but when we went to the Model A production, the tolerances were more

notably cut down than they were during the time of the Model T production.

Q. You made a more radical change when you went to the Model A? A. Correct.

Q. But still you were making changes and improvements? A. Yes, on the Model T.

Q. Do you have any particular system at the Ford Company to show or to keep track of changes in any of the parts from the beginning to the end of its production? A. Yes, we have a system for that, and we also have another system for the record on the tools.

(1252) Q. Are these the records that I asked you to produce on that particular subject? A. Those are the tool records.

Q. Tools and miscellaneous. These are different records than the engineering information? A. Yes, sir.

Q. These records you have now would not show any changes insofar as tolerances and things of that kind are concerned? A. No, sir.

Q. But engineering information would give that? A. That is correct.

Q. Do you know whether the engineering information cards for the T-410 cam shafts are available? A. I believe so, yes, sir. I say that because I looked up a record for Mr. P. E. Martin on the fly wheel dowel pin.

Q. It doesn't make any difference. A. I will get it. No, it was not the dowel pin. It was the triple gear pin that was pressed in the Model T fly wheel, and he requested the Highland Park record man—and I requested the Highland Park record man to bring out the complete engineering record of this particular part, and he produced the record from the time that the part started.

Q. I know I asked someone over the telephone to bring down the engineering information for the T-410 cam shaft, because I anticipated this subject might arise. I think it was you, and I think you have produced these instead of the engineering information, do you remember? A. You asked me for those cards.

(1253) Q. It was the engineering information I wanted. Is there anything about these particular cards which we have and which are called drawing index that would enable you by consulting them to see whether there had been any change in the standards, production stand-

ards? A. I don't believe these card records would show that, but the drawings would show that, the engineering drawings.

Q. And engineering information? A. Yes, sir.

Q. I think we will probably have to try to produce those? A. All right.

Q. Now, you stated on cross examination, as I recall your exact words, it was something to the effect, or it was that with your present knowledge and experience you believed you could now at the present time design and build a cam shaft shaper that would be faster than the Pioch machine and the Westinghouse and the Walcott, or any of them? A. I believe that could be done now.

Q. Just what did you mean by your present knowledge and information? What did you have in mind so far as the knowledge was concerned? Was it knowledge of this law suit or knowledge of those machines that you had learned about in recent years or what? A. The experience that we have had in the past years.

Q. I am going, in view of the other cross examination and discussion of the two wooden models we have here, I am going to hand you a letter signed by you and addressed to me, dated November 2nd, 1938. Will you please state what that is and **(1254)** the reason for it, or why you wrote it? A. That is a comparison of the—if we had used the cam shaft shaper on the Model A and the Model T. It shows the time, the actual cutting time for the Model T shaft as being 25.3 seconds, and the Model A cam shaft actual cutting time of 29 seconds.

Q. Now, that is a computation by you prepared at my request? A. That is correct, that is.

Q. And in that computation you took the information available on these drawings and were able, by taking that, to figure out exactly the speeds of the machine? A. Yes, sir.

Mr. Farley: I will ask that this be marked Exhibit 264.

(Letter above referred to was marked Exhibit 264.)

* * * * *

(1255) Mr. Farley: I didn't understand, Mr. Michael, whether you wanted me to produce the

original of that typed sheet, of which you have a photostatic ccpy. I think it is Exhibit 62.

Mr. Spohn: 62 and 63.

The Witness: Yes.

The Master: Excuse me a second.

Mr. Farley: Yes, sir.

(There was a short interruption.)

The Master: All right.

Mr. Michael: Well, I think it would be in order, Mr. Farley, if you produced here just until the time may come all exhibits that are not reproduced in the record.

Mr. Farley: Yes. That particular slip of paper I had Mr. Green looking for, he couldn't locate that during the lunch hour. I found the envelope in which that typed description and the originals of Exhibit 62 of those two drawings are the same number.

(1256) Mr. Spohn: 62 and 63?

Mr. Farley: 62 and 63.

Mr. Spohn: Yes.

Mr. Farley: And the system in connection with these as far as their coming into my possession, that when the case started, or shortly before, rather, the trial of the case before Judge Tuttle, I asked them to produce the drawings of the cam shaft shaper, and this yellow envelope that I have in my hand was produced, and it contained the drawings which I have here that are in it. Some of them were not introduced. We selected two of the drawings, they were assembly views to be put in evidence.

Mr. Michael: And they are 61 and 62.

Mr. Spohn: 62 and 63.

Mr. Michael: Or 62 and 63, yes.

Mr. Farley: My knowledge of these particular exhibits is that I was told that was produced in some file that the Ford Company had, which was, more or less, a record of inventions, and, apparently, these particular drawings were put in this envelope at the time the record was prepared in May of 1920.

The Witness: There are some more sheets here.

Mr. Farley: Yes, I know. And, I think, then, with that explanation, suppose we mark the envelope?

The Witness: There it is right on there (indicating).

Mr. Farley: Yes.

(Short discussion off the record.)

Mr. Farley: Supposing we mark this Exhibit 260—I haven't got the last exhibit number—I think it is 263 or '4.

(1257) A Voice: 265.

Mr. Farley: It is 265. Envelope in which Exhibits 62 and 63 and 61 were made, or were filed and received by Mr. Farley.

I might state, too, that the prints here have the reporter's stamp placed on it.

The Master: Yes.

Mr. Farley (Continuing): Exhibits during the trial before Judge Tuttle.

The Master: Yes.

Re-Direct Examination (Continued) by Mr. Farley.

Q. Now, referring to Exhibit 264, I notice that that says: "As per your request, we are giving below data of speeds and feeds for the cam shaft shaper based on information from you of 700 revolutions per minute for drive pulley," and, in that connection, I call your attention to Exhibit 62—63, and direct your attention to the inscriptions, "700 revolutions per minute" on the flywheel to which the arrow part, 115, is directed— A. (Interrupting): No. The part number is this (indicating). That is the sheet number (indicating).

Q. This is the sheet number (indicating)? A. Yes, sir.

Q. All right. The part number would be 6-Z-96-LL? A. Yes.

Q. Now, were you able to make these computations from the information given in these drawings based on the premise that the **(1258)** pulley which we have just referred to and the shaft to which the pulley is attached rotated at 700 revolutions per minute? A. Yes, we would. We would. Those figures are based on that condition.

Q. Yes. A. (Continuing): As shown on this drawing.

Q. Yes. Now, based on the premise then that your main driving shaft which is the one we have been talking about, runs at 700 R.P.M., and having a driven gear with a 13-inch pitch diameter, and a driving gear with a 4⅛ pitch diameter, you determined the speed of the crank by the computation shown in this Exhibit 264 as being 220? A. 220.

Q. Revolutions per minute? A. Yes, that is correct.

Q. Now, the crank to which we are referring is the shaft "S," which was marked on these wooden models, is that right? A. That is correct.

Q. And then for the next— A. (Interrupting): This also—pardon me?

Mr. Farley: Yes.

The Master: Go ahead.

A. Can I talk?

The Master: Yes.

Mr. Farley: Yes.

A. This also bears out the fact that the tools did not slide, but the work piece slid.

Q. Oscillated? **(1259)** A. Oscillated back and forth.

Q. Or "reciprocated" would be the term? A. Yes.

Mr. Michael: By "this," you mean the letter dated November 2, 1938?

A. Yes, sir.

Q. (By Mr. Farley, continuing): Now, then, in the next tabulation you have taken the circumference of the model T cam which you give as approximately 2.9 inches. A. Around that.

Q. 2.9 inches? A. Yes, sir.

Q. And then you divided, you got from the first set of computations the feed per stroke of 1/32, that is, 1/32 of an inch? A. That represents the amount cut.

Q. Feed? A. That is the feed.

Q. That is the feed? A. Yes.

Q. Yes. That is the width of the slice of steel that the tool would take off as it made each stroke? A. Each stroke, yes.

Q. And, then, dividing 1/32 of an inch feed per stroke into 2.9 inch, you have reached the answer of 92.8, and

which you take, then, as 93 strokes for the total rotation of the crank? A. Yes, correct.

Q. Then, you divide the total time, 16 minutes, divided by, or, rather, the time is 92.8 divided by 220, and you got 25? **(1260)** A. That is the number of strokes.

Q. Yes. A. (Continuing): Times 60, divided by the strokes per minute.

Q. Yes. And that gave you 25.3 seconds for the time for the cam shaft to make one complete revolution in cutting the model T cam? A. That is the cutting time, 25.3 seconds.

Q. Now, if the machine made two complete rotations, this time would have to be doubled? A. Doubled, yes.

Q. That would then give 50— A. (Interrupting): 50.6.

Q. 50.6? A. Yes.

Q. The latter being marked in lead pencil upon the Exhibit 264? A. Correct.

Q. And you followed the same process for the Model A shaft of finding the approximate perimeter of the shaft, and divided it by the 1/32 feed, and you get a total cutting time on that for one rotation of the cam, 29 seconds? A. Correct.

Q. And multiplying that by 2, assuming that the cam made two complete revolutions before the machine was stopped and shaft taken out; that gives 58 seconds, is that right? A. Correct.

Q. Now, then, this last one, surface speed of tool, you have taken again your computation which you have arrived at, of 220 strokes per minute? A. That is right, correct.

(1261) Q. And the cutting stroke would take 240 degrees of rotation of the shaft? A. Of the shaft that drives the arm.

Q. And the return stroke? A. 120.

Q. 120? A. Yes.

Q. Perhaps I will let you describe that. I understand that. But I would rather let you testify to that. A. We are calculating the speed of the tool. We take, as we have found, 220 strokes per minute of the slide necessary to finish one revolution, and we calculate the cutting stroke of 240 degrees and the return stroke, 120 degrees of revolu-

tion—that is the number of degrees that the driving gear takes that drives the arm which drives the work slide—now, the distance of the stroke of the cutting tool is 1¼ inches; therefore, with these conditions we get a surface speed of the tool of 34 feet per minute, which—

Q. (By Mr. Farley, interposing): Now, if you give—go ahead. A. (Continuing): —which is very conservative. It is low to what the speeds of the present day cutting tools have.

Q. How about cutting speeds of tools in, let us say, 1924 and 1934. Would 34 feet per minute be too high a cutting speed? A. No. That would be too low.

Q. Do you in your department have any particular standard established for the shop for speed in cutting feet per minute that should or should not be obtained by—or should or should not be exceeded, let us say, by the various types of tools? A. In 1934, or 1924?

(1262) Q. Well, generally. A. To the present day?

Q. Well, generally, do you have that sort of a system in the department? Is your department the one who would establish for the shop, the maximum cutting speed for any particular type of tool? A. Yes, sir.

Q. And, do you keep a record of that sort of thing? A. No, we don't.

Q. Well, now, considering the best type of tool steel available in 1924, let us say— A. (Interrupting): Yes.

Q. (Continuing): —do you have any present recollection of what the maximum speed ordinarily was in feet per minute? A. Our cutting speeds then were between 60 and 85 feet per minute.

The Master: With the kind of material that you would be cutting?

A. Well, yes; that would vary around there. On a piece of steel like this (indicating) of the cam shaft, I would say, conservatively, 60 per feet per minute.

Q. (By Mr. Farley): How about present day? A. Well, we have cutting tools now made of Tungsten Carbide that have a cutting speed of four times that much.

Q. Now, I wonder, Mr. Pioch, you haven't made any particular check, I know, of these two sets of drawings of the cam shafts between—

Mr. Spohn (Interposing): Pardon me, Mr. Farley, before you get into that.

Mr. Farley: It is in reference to this.

(1263) Mr. Spohn: Oh, is it tied up with the case?

Mr. Farley: Yes.

Mr. Spohn: Oh, yes.

Mr. Farley: All right.

Q. (By Mr. Farley, continuing): With Exhibits 62 and 63—with Exhibits 254 and 255, in so far as any change might have been made in the gears for the speed as computed in this exhibit, 262—

Mr. Farley: Mark this, please, Exhibit 265, Mr. Reporter.

(Thereupon, Exhibit No. 265 was marked by the reporter.)

(Discussion off the record.)

A. Now, let me see the other sheet. Compare these two (indicating)—I would say they are exactly the same.

Mr. Farley: I wonder if the Court understands the computation of taking the 240 degrees and 120 degrees of revolution?

The Master: Not entirely.

Q. (By Mr. Farley, continuing): I wish you would explain just what that is, and by referring to the drawing, explaining how the drive operated. You understand my question? A. Yes.

Q. Yes. A. Well, this hasn't got any reference mark here (indicating on blue-print).

Mr. Michael: Do you want him to refer to this print or the other one?

Q. Let me first ask the question, Mr. Pioch. You are now referring to Exhibit 254?

The Master: Exhibit 254 is the one he is referring to.

(1264) A. Yes.

Q. (By Mr. Farley): Well, let me first ask, have you inspected these two drawings sufficiently? 254 is the same type of a showing as Exhibit 62? A. That is right.

Q. That is right? A. Yes.

Q. Now, have you checked those drawings sufficiently to see whether it would make any difference in the explanation as to the mechanism for driving the carriage? A. No, it wouldn't.

Q. Do both of the drawings show the same mechanism? A. Yes, sir.

Q. And, I might, while I am on that, have you also check the other parts of the machine shown on these two drawings to see whether you see any change of any importance that would modify the operation? A. Not the operation, no, sir. There is a difference.

Mr. Spohn: Yes.

Q. Do you know what particular difference there is? A. Well, the one shows the one steady rest, and the other shows three. That is the only difference I see right now.

Q. All right. Now, if you will proceed with your explanation? A. Yes. Well, I don't know whether I would be able to make myself clear on this drawing.

Q. Do you want to use the other one? A. No. It is the same.

The Master: Now, could you explain it without referring to the drawing?

(1265) Mr. Farley: Well, how about the wooden model?

A. Well, the wooden model shows it exactly.

The Master: Well, let's see the wooden model, then.

A. Yes, sir.

We will refer to the wooden model marked Exhibit 237. And we will position the hand lever representing the driving gear of the shaper, and we will position this hand lever at the start of cut and mark same with pencil, start of cut.

Q. (By Mr. Farley): Now, before you start that, Mr. Pioch. A. Yes.

Q. The starting crank is on the shaft, that would be the main driving shaft of that part of the machine? A. Yes.

Q. That when that shaft makes one complete revolution the work carriage will have completed a cutting and return stroke? A. Correct.

Q. All right.

The Master: And that rotates counter-clockwise?

A. Yes. And this shaft rotates facing the machine in a counter-clockwise rotation.

The Master: Yes.

A. We will turn this crank until it comes to the—until the work slide comes to the end of its travel, and mark thereon, a line, finish cut.

Q. You had a line marked on the front of the model, the start of the cut? A. Yes, sir.

Q. And through how many degrees of rotation did you rotate the shaft from the start cut to the finish cut position? **(1266)** A. 240 degrees.

Q. All right. A. Then we will continue to rotate this crank back (demonstrating). It is about there (indicating) to the starting position.

Q. And during that continual rotation of the crank, you have rotated through how many degrees? A. 120 degrees.

Q. I think that explains it. And just one question there. And in those machines the shaft on which you have the starting crank, rotated at uniform angular velocity, is that right? A. Pardon?

Q. The crank which you are manipulating in the actual machines rotates at a constant speed? A. Yes, sir.

Q. At regular uniform angular velocity? A. Correct.

Q. All right.

Mr. Farley: Now, I will offer Exhibit 264 in evidence, and I will offer the brown envelope in which I received Exhibits 62 and 63 in evidence as Exhibit 265. And I will offer as Exhibit 266, the computations made by Mr. Pioch in connection with the change of the center bearing of the Model A shaft.

* * * * *

(1270) The Master: In making these computations for the model A, what kind of a shaper did you have in mind, the style of shaper that is embodied in the wooden exhibit that you had made?

A. Yes, sir.

The Master: And would this be the machine time of that type of shaper?

A. Yes, sir.

The Master: I think the exhibit is admissible. I will admit it in evidence.

Mr. Spohn: Now, your Honor please, with respect to Exhibit 266—do I understand that that exhibit—is this it, Mr. Pioch?

A. Yes.

Mr. Spohn (Continuing): That that sets forth the change of bearings necessary in that, that it had something or other to use in shaping the model A?

(1271) Mr. Farley: Yes.

A. It is to use the shaper without putting the attachment on.

Mr. Spohn: If your Honor please, I object to the offer. It is incompetent, irrelevant and immaterial, all of the testimony on that offer with respect to what modifications could have been made of model A cam shafts. We are here dealing with a standard of comparison, profits, gains, and advantages. I assume that they could have changed their course in many respects. It is not what they might have done. The question is what they did with the infringing machine.

The Master: Would you object to the machines being used as a standard of comparison—well, to make my question clearer, let us take an actual assumption: Suppose that in the model A they had used the same type of bearing as was used in the model T instead of having an enlarged bearing, that the entire shaft had been made of slightly larger diameter, and slightly longer—all increases being the same proportion—but the shape of the shaft being exactly the same as with the model T. Now, before the cam shaper could be used on the model A it would be necessary to at least make the shapers somewhat larger.

Would you say that if that situation were presented it would be impossible to use the model T cam shaper as a standard model of comparison?

Mr. Michael: You mean that if the model A shaft would be the same as the T, except slightly larger?

The Master: Yes.

(1272) Mr. Michael: I don't think that would make any difference.

The Master: It would be necessary to enlarge the model T.

Mr. Michael: I understand not.

The Master: If the shaft were slightly longer, why, you would have to change the position of the tools. You would have to make your shaper of slightly different dimensions.

Mr. Michael: Well, you would have to position your tools over the shaft.

The Master: What I am wondering, to what extent you would take into consideration the modifications of a machine which would have been feasible and simple to make if the defendant hadn't been in a position to avail himself of the infringing machine which he actually used.

Mr. Michael: Well, the law is, as I understand, is pretty strict of what you could do. However, it wouldn't go so far as to permit one instance—suppose the Walcott machine was brought in as a standard. Certainly my objection wouldn't go so far as to prevent the man from changing the master cam on that machine, or re-positioning his tools to cut an identical shaft. I don't think that question is presented here at all. Where a man comes in in 1939 and tells us what he thinks he would have done in 1925 on the car, what parts he would have changed—he isn't changing the shaper.

The Master: Well, I will admit that we are in a **(1273)** slightly different position right now. We are considering the question of not the change of the machine itself, but the change of the part being made. But, I think the general problem there is just about the same.

Suppose the facts were that the model A cam shaft had just a slightly larger bearing than the model T, instead of a very much larger bearing, as far as the end bearings and center bearings were concerned, and

that there was no particular reason for the change that one cam shaft would function just as well as the other, and that it just so happened; that they decided to make the change without any mechanical necessity or advantage of doing so, but that with such a change it would have been impossible to use the original machine for producing the shafts in the same manner in which it was originally designed, couldn't you then take into consideration the probability or the possibility that if the defendant hadn't been able to avail itself of the infringing machine, it would very likely have used the same shaft rather than make any alterations at all in it?

Mr. Michael: Well, personally I had great difficulty, in what he might have done in 1925. I think it is too far in the realm of speculation to even be considered in evidence. And, in your last question you certainly indulged in some rather violent assumptions, your Honor.

You assume that a cam shaft in a motor or an automobile in a rapidly developing industry like motor vehicles can be any old thing they want to make it to put it into a machine that was current in 1914. I would say you are going pretty far afield. The model A motor was a decided **(1274)** advance and improvement of anything Ford has had prior to that. And, now, to sit down here and re-design the cam shaft, knowing that when you do that you would have to redesign a hundred other things. I think we are out of the realm of investigation.

Mr. Farley: Suppose I may be allowed to go on—

Mr. Spohn (Interposing): Still objecting, your Honor.

The Master: Yes.

Q. (By Mr. Farley): Now, supposing, Mr. Pioch, for example, you made a change in the model T, you still have the model T cam shapers available? A. Yes.

Q. And for some reason or other you found it desirable to increase the length of the model T shaft, the cam shaft of the model T, let us say, 5 inches— A. (Interrupting): Yes.

Q. And, let us say you changed the bearings, let us say, assume that you put 2 intermediate bearings instead of one central bearing— A. (Interposing): Yes.

Q. (Continuing): —could you have used the model T cam shapers you had at the plant at that time to machining the shaper? A. We could by making a new head.

Q. You would have had to— A. (Interrupting): You would have had to rebuild the head, and re-space the tools, and re-space your supports.

Q. But that would involve— A. (Interrupting): But it would not affect the rest of the machine.

(1275) Q. It wouldn't change the principal part? A. No. The driving mechanism and the indexing mechanism would remain.

Q. Suppose now you had decided, instead of having the cams 7/8 of an inch long, you would make your cams 1½ inches long, or wide, if you understand what I mean— A. (Interrupting): Yes, sir.

Q. (Continuing): —would you then have been able to use that machine, or would you have to re-design it? A. Yes, we would have to re-design it, because the stroke, I think, is one inch and one-quarter, and we would have to change the entire driving mechanism.

Q. Now, suppose when you went to model A production, you had had at that time, suppose you had been confronted with the question of infringements that we have here now— A. (Interrupting): Yes, sir.

Q. (Continuing): —and you had found it absolutely essential to use Walcott machines? A. No, sir.

Q. I want to state for your information, and I think it is permissible, that the Walcott machine had been charged to be an infringement, and the case was tried that was brought by the Gordon Company against the Walcott Company was tried before his Honor, Judge Simons, and on July 22nd, 1927, Judge Simons handed down a decision stating that the Walcott machine did not infringe the Gordon patent? A. Yes.

Q. In July of 1927, or rather, in the period when you were designing **(1276)** the model A machine, or model A automobile, that period ran from May of 1927 to December of 1927? A. About that time, yes, sir.

Q. And the Ford Motor Company at that time had 16 or 18 Walcott machines already in the plant? A. Yes, sir.

Q. You knew of those machines being there, did you? A. Yes, sir.

Q. Personally? A. Yes, sir.

Q. And they had been in operation at the Ford plant for about three years, to your knowledge? A. Yes.

Q. That is, those machines were purchased— A. (Interrupting): Yes, sir.

Q. (Continuing): —in the early part of 1924? A. Yes, sir.

Q. Now, was there any occasion during that time, during the design of the model A, or any necessity to consider using the shapers in place of the Walcott machines? A. No; I don't remember.

Q. Now, let me see: During the period of your design of the model A, were you in any way associated or connected with the engineering design under Mr. Sheldrick, or did you give any part of your time or attention to the design of the model A car? A. Yes. At that time I was out at the engineering laboratory where the car was being designed every day during the process of **(1277)** the development of the model A car.

Q. And, did you during that time, period of development, consider the design of parts of the model A from the standpoint of production? A. That was the purpose of my being out there, to make suggestions on the design of parts that would fit in with the production machinery.

Q. Did you make any particular suggestions, or did you make one or several? A. I believe I made many.

Q. Very many? A. Yes, sir.

Q. In connection with the computation which you made, Exhibit 266, that computation was based, as I understood it, and had to do only with the center bearing; would you have needed to consider the change of any other part of the cam shaft to have used the model T shapers—let me see—am I correct in assuming that when you talk about cutting the center bearing— A. (Interrupting): No. We were going to change this bearing (indicating), and this bearing.

Mr. Spohn: The center and the end bearing.

A. Yes, that is right.

The Master: Did you make a computation of both?

A. Yes.

Q. (By Mr. Farley, continuing): The computation included both, did it, or just the— A. (Interrupting): Well, wait a minute—no—it just referred—this computation refers to the center bearing.

Q. Yes, I thought I was correct. **(1278)** A. Yes, this is the center bearing (indicating).

Q. Now, with that change, and, assuming that the old model T shapers were still in the shop and available to you— A. Yes.

Q. (Continuing): —what other changes, if any, would you have had to make in the model T cam shaft as shown by Exhibit 237? A. If we hadn't changed the bearings?

Q. If you had changed—we are going to assume that you changed the center bearings. A. Yes, sir; changed this (indicating).

Q. Yes? Now, would it be necessary to do any more than change the center bearing if you were going to use the old model T shapers as they were then? A. No. I believe not. We could—my mistake was turning that crank there. We could turn the crank the other way and make this pressed on bearing on this end (indicating), and cut in the other direction, then we would leave this end bearing the same.

Q. Yes. A. Wouldn't have to touch this.

Q. Wouldn't have to touch this? A. No.

Q. You wouldn't have to touch the bearing on the flange? A. No. That is right. Instead of cutting in this direction (indicating) to the left—

The Master: Well, is this shaft in the right position? Isn't the flanged bearing usually on the left rather than the right?

A. Well, this is the front end. The flanged end is this **(1279)** (indicating).

Q. (By Mr. Farley, continuing): Well, let us turn it this way. A. Yes.

Q. Now, with these— A. (Interrupting): This (indicating) is the part.

Q. (Continuing): —shaft, Exhibit 234, in front of you? A. Yes, sir.

Q. You have the flanged end of the shaft on the left side? A. Yes, sir.

Q. And with the machine as shown in the blue-print which is in front of you, Exhibit 264 or 265, I don't know which one it is—the tools as shown there, or, wait a minute—you are holding the shaft now, the exhibit, physical shaft, Exhibit 234, in the same position that it would be in the machine? A. Yes, sir.

Q. And the tools would be cutting from the left towards the right? A. Yes, sir. That is, the slide would be moving from the right to left.

Q. From right to left? A. Yes, sir.

Q. Now, in that position you would have interference on the large bearing on the flanged end, and on the center bearing? A. Yes, sir.

Q. Now, your testimony now is, that if you had the tools traveling in the other direction, or, if you turn your shaft end for end— A. (Interrupting): Yes, sir.

Q. (Continuing): —so as to bring the shaft, flanged end now to your right hand. A. Right hand.

(1280) Q. Then in making your—which you compute on Exhibit 266, what then would you do then as far as any tool interference were concerned with the bearing now on the left-hand end of the cam shaft? A. Why, under those circumstances, conditions, we wouldn't have to change the front end bearing, but we would have to make, we would have to make the rear bearing a separate piece, that would have to be passed onto the shaft after the shaping operation.

Q. Is there anything unusual about that operation? A. No, sir.

Q. How would that affect the operation of the engine? Would it improve or detract from it? A. It wouldn't affect it any.

Q. If any, it might tend somewhat to improve it, wouldn't it? A. Well, I won't answer that. That would have to be tested, Mr. Farley.

Q. Well, what other changes, if any, would you have had to make in one of the old model T cam shaft shapers, assuming a shaft as you have described it, in order to use that physical shaper as you used it on the model T's? A. We would have to re-space the tools.

Q. Well, how about the master cams? A. And we would have to produce new master cams.

Q. Now, do you know whether or not you made any changes at all similar to that in changing over the Walcott machines from model A to model T shafts? A. We had to do the same thing.

The Master: Model T to model A?

(1281) Mr. Farley: Model T to model A, yes.

A. Model T to model A, yes, and we had to make new master cams and re-space our tools.

Q. Now, when you were cross examined about the wooden model exhibit—

Mr. Spohn (Interposing): Just a moment, Mr. Farley. I thought this was all preliminary yet to the Master's ruling on Exhibit 266.

Mr. Farley: Yes. I will re-offer Exhibit 266, but I just have one more question and I will be through.

Mr. Spohn: Yes.

Q. (By Mr. Farley, continuing): In connection with the cross examination on Exhibit 266, the wooden model, you were asked about a number of parts, and I think the final question was that if you found anything like that in the prior art, as far as the prior art is concerned—do you understand what is meant by the expression "prior art"? A. Well, I believe I do. It is the operation used before.

Q. Used before? A. Yes, sir.

Q. What basis, if any, was there in the prior art for the model A type of cam shaper with the attachment such as you have in Exhibit 256, and such as you have in the drawings 254 and 255, and also the drawings 257 and 258? A. Well, the wooden model A cam shaper as to prior art represents the planer and the shaper. But the set-up of that model, I did not see before, of one set of tools cutting in one direction, and another set cutting in another direction. That was the answer that I had reference to to the question I **(1282)** made before.

Q. Now, how about the principle of operation? Whether or not there is any departure from the principle of operation from the model T shapers, the old model T shapers? A. No, sir, there isn't.

Mr. Farley: I think that is all. And I renew my re-offer of Exhibit 266.

The Master: Do you know whether there were any Landis grinders in existence from the period, 1927 to 1931, and, which, without modification, would have machined, or rough ground the cams on the model A cam shaft?

A. There were grinders then, yes, sir.

Mr. Farley: Without modification?

A. Well, they would have to have new masters.

The Master: Would that have been the only change necessary, do you know?

A. Yes, sir.

The Master: Are you familiar with the operation of the grinder?

A. Yes, sir. That would have been the only change, and new steady rests.

Mr. Farley: And would that change be different, or the same as the change in the model T shaper with the model A cam shaft of the type you just described?

A. It would mean the same change.

* * * * *

(1298) The Master: I am wondering if whether it would be your opinion as to whether it is a desirable feature of a side-cutting tool to have the angle of the upper surface of the tool to be tangent to the work.

A. That is desirable, your Honor. But after you go through all the trouble of tilting the tool, your advantages gained there seem to have been lost in the fact that the tool is not rigid enough.

* * * * *

(1302) Re-Cross Examination by Mr. Michael.

* * * * *

(1303) Q. You were speaking in your re-direct examination of leaving a bearing off of the A shafts? A. Yes, sir; pressed bearing, yes, sir.

Q. Is that it? A. Yes, sir.

Q. Would that have added any cost to the shaft? A. Yes.

Q. It would have also added— A. (Interrupting): Operation for pressing it on.

Q. Operation for pressing it on? A. Operation for pressing it on, yes, sir.

Q. And you would have had to make it first? A. Yes, sir.

Q. (Continuing): Before you put it on? A. That is right, yes.

Q. Now, you said, as I understood you, that this attachment on the race-horse machine was a combination planer and shaper? A. You have reference to the Model A cam shaper?

Q. Well, this machine, the wooden model with the attachment on it. A. Yes, sir.

Q. Is that what you said, a combination planer and shaper? A. You could call it that.

(1304) Q. Well, what do you call it? A. I call it a cam shaft shaper.

Q. Yes. But in answer to a question of Mr. Farley's as to what you based it on, or something of that character— A. I said it had the combination of both machines. The principle of the planer and the shaper.

Q. Yes. A. And that it has that definitely.

Q. How? A. Definitely.

Q. Well, did you ever see a planer in which the tool chased the work? A. I don't believe I did.

Q. Did you ever see a shaper in which the tool— A. (Interrupting): Chased the work? They are all that way.

Q. No; I mean where both are moving in the same direction, one chasing the other? A. No, sir.

* * * * *

(1305) Q. (By Mr. Michael, continuing): Let's assume that Model T production stopped in May, 1927, when you started developing A—that would have started before that, wouldn't it? You certainly would have made up your minds to develop another car before you quit making one? A. Yes, I would say so.

Q. Have you any recollection on it, or knowledge on it? A. I know we were doing some Model A work right about the time we stopped the Model T.

Q. What kind of work? A. Developing a new engine: developing a new chassis.

Q. Did the engine come first, the motor; did you work on that first, or was that one of the first things? A. I believe it was. I believe it was.

Q. And that is the element in which these Model A cam shafts we have been talking about here were to be used at? A. Yes, sir.

Q. Well, did you know, or did anyone tell you at that time that there was a suit pending against the supplier of the Walcott machine? A. No, sir.

Q. Based on an infringement of the Gordon patent? A. No, sir; I didn't know that.

Q. You didn't know that? A. No, sir.

Q. And no one in the Ford organization told you? **(1306)** A. No, sir, no one told me.

Q. Well, were you ever informed on anything by the Ford Motor Company that anything you are working on involved a patent question? A. Yes, sir.

Q. Who tells you that? A. Well, all depends who has that information. That would be our patent attorney. It might be our superintendent. It might be Mr. Weibel.

Q. Do you consult your patent attorney or Mr. Weibel? A. Only when they come to me.

Q. Only when they come to you? A. Yes, sir.

Q. And I think this morning you said you had only been informed there was a question on two different items that you have handled? A. What were they?

Mr. Farley: I believe I might correct that, if you don't mind, Mr. Michael. That was a statement as to questions of changing only of where a purchase of machinery had been held up because of the fact that questions of patent infringement came up.

A. Oh, yes, yes. I only stated I knew about those cases, but I never had anything to do about it, or with it.

Q. (By Mr. Michael): Well, are there any other cases in which Mr. Weibel or the patent attorney had been called in to consider designing that you had been doing? A. It might be, but if it necessitated suit against the Ford **(1307)** Motor Company, where eventually we would have to get rid of the thing we are talking about, they would consult me about it, I believe.

Q. Well, as far as you know, would that be the only instance? A. Yes, as far as I know.

Q. It wouldn't be a question of any patent that might cover, owned by someone else, and— A. (Interrupting): If we were designing it?

Q. If you were designing it, yes? A. Oh, yes, they would let me know about that, certainly.

Q. Let you know about that? A. About what we are talking about.

Q. Let me make this clear. Let us assume you are working on a machine, or want to use a certain machine. A. We have been assuming that right along.

Q. Or want to continue to use a certain machine; there is a patent on the machine held by some third party who claims that your supplier of that machine is infringing? A. Yes.

Q. Would you know about that, or would that come to your attention in the ordinary course of business? A. It might.

Q. And what would you do about it? A. After they called my attention to it?

Q. Well, yes. A. I would start work on it.

Q. You would try to avoid the infringing— A. (Interrupting): I would try to avoid the infringing part (1308) of the machine, yes.

Q. You would try to avoid the infringing part of the machine? A. Yes.

Q. And if you couldn't avoid it, what would you do? A. I guess I would have to give up if I couldn't. It would be the only thing left.

Well, I am assuming that nothing could be done—he said if there is nothing else could be done, and we were stuck, then we would just be stuck.

Q. Now, on the changes that you propose to make in the A shaft, or said you might have considered in 1924, if you wanted to build a shaper, your first proposal, as I understand it, was to increase the diameter of two bearings, and reduce their longitudinal extent? A. Yes, sir, that is right.

Q. And your second one was to put on a second bearing, or cut one off and put on a pressed bearing later? A. Correct.

Q. But that would still entail reducing the longitudinal extent of the center bearing and increasing the diameter? A. Correct.

Q. And, then, in either of those events, you would have to shorten up or make some change in the tool holders, would you not? A. I think we—oh, one tenth of an inch.

Q. Well, I think the sketch you made of that, you showed the end of the tool holder as perfectly square across the bottom? A. Yes.

(1309) Q. When, as a matter of fact, they had a pitch to them, didn't they? Didn't the tool holder, as used in the shaper, have a pitch forward? A. Yes, sir, that is to take care of the proper cutting angle.

Q. I am not speaking of the tool now. I am speaking of the tool holder. A. It had a pitch.

Q. Yes. The under edge on it was pitched forward, wasn't it? I think it is shown that way in the drawing.

Mr. Farley: Suppose you look at the drawing.

Q. You also have it in your wooden model. A. (Referring to drawings.) No, these are not the ones.

Mr. Michael: What exhibit is this?

Mr. Spohn: 254.

Q. (By Mr. Michael, continuing): And, in this exhibit, 254,— A. (Interrupting): Yes.

Q. (Continuing): —aren't the tool holders all pitched forwardly? A. Yes, sir, in the cam shapers, yes, sir.

Q. And the tools all slant forward? A. Yes, sir.

Q. Now, how would you have to change that if your bearing was increased? A. You wouldn't have to change it.

Q. You would leave— A. You would leave it at the same shape. You would bring this line up one-tenth of an inch—this line right here (indicating). That tool holder could be brought up there one-tenth of an inch.

(1310) The Master: Leave this discussion off the record.

(Discussion off the record.)

Mr. Farley: Suppose you mark that, Mr. Pioch, on the Exhibit 254.

The Master: 254, yes.

(The witness does as instructed by counsel.)

(Discussion off the record.)

Q. (By Mr. Michael): Well, now, with that change you have just sketched there, your clearance would still be rather critical, would it not, between the bearing and the actual cam? A. Well, I would have to lay that out to scale.

Q. Well, you said one-tenth of an inch? A. Yes, sir.

Q. And you did that after some figuring? A. Yes, sir.

Q. Well, assume you gave it one-tenth of an inch, you still have quite a critical relationship there between the bearing and the actual cam? A. No, I don't believe so.

Q. For loading and unloading purposes? A. No, sir.

Q. Wouldn't be any likelihood of that? A. I don't think so.

Mr. Michael: That is all I have.

Re-Direct Examination by Mr. Farley.

Q. Just two more questions, I think. On the proposition that you first discussed about the Model A shaft and the changes of **(1311)** the bearings where you made your computation upon Exhibit 266, if you had merely changed the length of the bearings and probably increased the diameters, would you state whether or not that would have added any cost or any extra operations? A. It would not.

* * * * *

The Master: You recognize that there is more of a strain on the tool in the Westinghouse machine than in the Walcott, or do you?

A. Yes, there is.

The Master: But, you think that the—

A. (Interrupting): The advantages gained by the tool following like on the Walcotts, I believe the advantages are lost, because from the tests we made have shown that.

Q. (By Mr. Farley): In other words, the effort to keep the **(1312)** tool constant to the work in the Walcott machine which is accomplished by all of the oscillating cams, oscillating tools, springs and other things, is a penalty

which you have to pay that isn't worth the price of keeping the tool constant? A. That is correct.

Q. Over Westinghouse? A. That is correct.

Mr. Farley: I think that is all.

* * * * *

(1315) NIELS BOESEN was thereupon called as a witness on behalf of the Defendant herein, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. Your full name, please? A. Niels Boesen.

Q. Where do you live, Mr. Boesen? Where do you live? A. On 12720 Tuller Avenue.

Q. And you are employed by the Ford Motor Company? A. Yes.

Q. What position at the Ford Company? Your job at the Ford Company? A. Well, I take care of designing special machines. I got a gang that does that only.

Q. And you work in Mr. Pioch's department? A. Yes, under Mr. Pioch.

Q. Now, did Mr. Pioch give you any particular instructions concerning the making of some drawings relating to the Ford cam shaft shaper? A. Yes, sir.

Q. I show you Exhibits 254 and 255 and ask you if you are familiar with these drawings? A. Yes, I am.

Q. And will you just state what work you did in connection with the particular drawings? A. Well, Mr. Pioch brought these prints down to my division and told me that that was a machine that had been used for the **(1316)** old machine cam shaft, and he told me we could find a way whereby we could change that machine over to use on a Model A. As to now, we couldn't use the Model A because there isn't room for two tools there. So, he asked me to devise, or help to devise, a way whereby we could change that machine over so that we could use it on the Model A.

Q. Yes, go ahead. A. And we studied, of course, and talked about it and came to the idea of which we made a model, which is over there (indicating).

The Master: I don't know if it is of any importance, but you weren't familiar with the machine itself until Mr. Pioch brought it to your attention?

A. No. I have never seen prints before now.

Q. (By Mr. Farley): Now, were you able, when Mr. Pioch brought the particular prints to you, to tell from an examination of the prints the way in which the old machine worked? A. No, not right away. It was a conclusion of ours—

The Master (Interposing): Pardon me, Mr. Boesen, I think if you are careful not to rattle these papers, the stenographer can probably understand you better.

Mr. Michael: What was the last answer, please? I didn't get that.

The Master: Read the question also, Mr. Reporter.

(The question and answer were then read by the reporter.)

Q. (By Mr. Farley): After you had inspected these blue-prints— A. (Interrupting): Yes.

Q. (Continuing): —for a couple of hours— (1317) A. Yes.

Q. Did you then understand the manner in which the machines shown in the drawings worked? A. Most of that.

Q. The old machine? A. Yes; the main movements, I could see that.

Q. Now, then, what next did you do? A. Well, we came to the conclusion that we could take those two cams by the method that we have shown over there on that model.

Q. "That we could cut those two cams," did you say? A. Yes, by that method we showed on that model we got over there.

Q. Now, then, what did you do? A. Well, we made a layout of which you have a print, and from that we built a model.

Q. Now, I call your attention to certain crayon lines on these two exhibits. A. Yes.

Q. 254 and 255? A. Yes.

Q. Were those crayon lines on those prints when they were first brought to you by Mr. Pioch? A. No.

Q. And who put these additional crayon lines on these prints? A. The designer, who took care of it, and myself, Mr. Pioch figured out how they were going to do it. He put the lines down.

Q. That is, one of the men who is working under you? **(1318)** A. Yes.

Q. In Mr. Pioch's department? A. Yes.

Q. And when you referred to the layout of which I have a blueprint, you were referring to the sheets of drawings, 257, 258, and 259, is that correct? A. According to this one here (indicating).

Q. And that is Exhibit No. 257? A. Yes.

Q. And who made this particular drawing? A. That same man.

Q. What was his name? A. Wayne Houtary. He is one of my men.

The Master: How do you spell that?

A. H-o-u-t-a-r-y.

Q. And how about the drawing, Exhibit No. 258? A. The same.

Q. The same with respect to that? A. Yes.

Q. Made by Mr. Houtary? A. Yes.

Q. And the same with respect to drawing No. 259? A. The same thing.

Q. Made by Mr. Houtary? A. Yes, sir.

Q. Now, let me ask you, Mr. Boesen, in making these drawings, and assigning this job to your assistant, Mr. Houtary, did you depart in any way from your regular procedure there around **(1319)** the Ford plant? A. No. That is the way we do it.

Q. Are you familiar with the standard shaper drive? A. Yes.

Q. Will you state whether or not, or, let me ask you —how long have you had personal knowledge, yourself, of the type of machine tool known as the shaper? A. Oh, I would say—oh, I would say 45 years.

Q. And, now, will you state whether or not the drive for reciprocating the work carriage as shown originally in the drawings, 254 and 255, is or is not the same as the

standard shaper drive that you have known about for 45 years? A. Yes, that is the same thing.

Q. Will you state just what you did with respect to the two tools that you referred to as not being able to cut the cams on account of interference with the bearings on the Model A shaft? What did you do with respect to those two tools? A. We mounted them on a slide that is 90 degrees away from the other slides. You see, the other two slides came this way (indicating).

Q. The other came down vertically? A. Yes. And this one we attempted to make is horizontal.

Q. Yes; and at 90 degrees? A. And operated on the same shaft as the one that operates the cam shaft for cutting the other cams. We drew that right in the same shaft by making that crank so much larger that the slide has a chance to not only catch up, but to do its work and finishing at the same time the motion of the cam **(1320)** shaft ends. In other words, all the tools on the top, as well as the tools on the slide to end at the same time.

The Master: Will you just read what you have, Mr. Reporter?

Mr. Farley: Yes, I was going to suggest that.

(The answer was then read by the reporter.)

The Master: That is all right.

A. This should have been longer (indicating).

The Master: All right.

Q. (By Mr. Farley, continuing): Now, as I understand it, the machine, in your testimony, in so far as the mechanism for driving the slide which carried the two tools that are horizontally arranged are concerned— A. (Interrupting): Yes.

Q. (Continuing): —you hooked the driving mechanism for that right to the same driving mechanism? A. Exactly.

Q. And that mechanism— A. (Interrupting): Yes.

Q. (Continuing): —which you hooked that to was the old shaper drive? A. Extension of the shaft, of course, had to be done.

Q. And the same sort of a driving mechanism that has been used, to your knowledge, for 45 years? A. Yes.

Q. In the shaper? A. Yes, sir.

Q. Now, will you state, in so far as your slide is concerned with the two horizontally arranged tools; would you call that **(1321)** a shaper-cutting action? A. Yes.

Q. You understand? A. Yes.

Q. And that shaper-cutting action is one in which you have the tools, the shaper tool mounted? A. Yes.

Q. On a reciprocating ram? A. Yes.

Q. And as the ram which carries the tools? A. (Interrupting): The work is standing still.

Q. Beg your pardon? A. The work is standing still.

Q. The work is standing still? A. Yes.

Q. And the cutting action is performed by driving this ram? A. Yes.

Q. And making the tool traverse across the work? A. Yes.

Q. Now, is that principle and that same driving mechanism employed in this slide with the two horizontal tools that you laid out? A. Yes; yes, that is the same.

Q. Do you know about how long it took this man and yourself to prepare these particular drawings? A. You mean just what we made here (indicating)?

Q. Yes. A. Oh, I would say two—three days—three days, I think, probably, it took him about three days.

(1322) Q. I don't see any particular date on these drawings? A. No. We forgot to put that on.

Q. Do you remember when it was these drawings were made? A. Oh, it is about half a year ago; something like that. I don't exactly remember. I think that is what it is.

Q. Now, in connection with this general proposition of using the shaper, such as shown in the drawings 254 and 255— A. (Interrupting): Yes.

Q. (Continuing): —for the machining of a Model A cam shaft, did you consider any other type of modification of that machine, other than what you have put on these drawings? A. I think there was a couple of other ideas, but I have forgot now what they were. However, this was the one that we talked about that we thought would be the one we would employ.

Q. Yes. Was this particular modification considered, if you know, or, if you recall, from the standpoint of employing the old Model T shapers such as shown in these

prints to the fullest extent, or, was it considered from the standpoint of what you would do if you had started to re-design the machine entirely? A. Well, if I had to start to re-design the machine entirely for that same cam shaft, I would have made it a little bit different. I would make it in such a way that it would be, still be tool slides; one that would hold the stationary tool; one that would slide the cam shaft, and that slide that we have, I would put, I would put them opposite each other, 90 degrees—you know, this way (indicating), and that. I would make them so the tools would cut opposite.

The Master: You would make them all horizontally?

(1323) A. What?

The Master: You would make them all horizontally?

A. Yes; and they would counteract each other.

The Master: You have two on one side and six on the other?

A. No. I think I would take—let's see—four on each side.

The Master: Yes.

Q. (By Mr. Farley): Would the making of the drawings such as you have made, and which you have before you for the re-design you are just talking about, present any different or more difficult problem than you are confronted with there in your regular daily work there, Mr. Boesen? A. No, not a bit. I could see we could make that.

Q. About how many special machines have you made designs for in your experience as a machine designer? A. Oh, gee, that's—that's hard for me to say.

Q. It would be hard for you to say? A. Yes. I never kept track of them, but it is a good many.

Q. Would it be a matter of— A. (Interrupting): Several hundred, I would say.

Q. How long have you been doing that particular type of work at the Ford Company? A. Since I came to the Ford—that was—I think it was '21, or—'21, yes.

Q. And were you doing work of that type in any other plant? A. Yes.

Q. Before you worked at Ford? A. Yes.

Q. Had you designed special machinery in other plants? **(1324)** A. Sure.

Q. Where, for example? A. Lincoln.

Q. And Lincoln Motors? A. Before it was bought by Ford.

Q. And how long were you with the Lincoln? A. As long as it lasted.

Q. How many years? A. Was it three years? I guess. Yes.

Q. Well, that would be, that would have been from about 1917 to 1920, or thereabouts, is that about right? A. I came to Lincoln right after the War.

Q. That would be between 1918 and 1921? A. Yes, and I was there—

Q. (Interposing): And before that you were with Northway, did you say? A. Oh, I was with several other concerns.

Q. In this country? A. Right here in Detroit. I was once with the Brush. In fact, that was started in 1909 here in Detroit.

Q. Was Mr. Alanson P. Brush, who is now in the courtroom, in charge of the company at that time? A. I don't recall. We started to make tools for the Briscoe at that time.

Q. Now, was it in 1909 that you first started in the design of machine tools for the automobile industry? A. Yes.

Q. So then for the last 30 years— **(1325)** A. (Interrupting): Yes, sir.

Q. (Continuing): You have been in that work? A. Yes, sir.

Q. And has your work been mostly that of designing special shop machines? A. Yes, sir. Tools; also work.

Q. Tools? A. Yes.

Q. Will you state whether or not the work in that connection at the Ford Company differs from the experience you have had in other companies? Is it the same? A. It has not—it is the same.

Q. It is the same? A. It is the same, yes.

Q. Had you done any—had any experience in the design of special machinery in other industries outside of the

automotive industry before you got started in the automotive industry? A. No.

Q. That was your first machine tool designing work? A. Yes.

Q. Now, in addition to these drawings which we have just been discussing, you prepared some other drawings showing a different expedient or different way of having the cam shaft, or using the cam shaft for shaping Model A cam shaper, did you not? A. Yes. Just a little sketch would show another way of—

Q. (Interposing): Yes.

Mr. Farley: I produce two more drawings and ask that they be marked Exhibits 268 and 269.

(1326) (Exhibits 268 and 269 were then marked by the reporter.)

Mr. Farley: Now, I might state at this point, if the Court please, that Mr. Oberhoffen, the original designer of the Model T cam shaper, was interviewed by me and he outlined a scheme that he not only stated he had in mind back in the days when he was at the Ford Company, but, when I asked him the question, "Could your machine be used for the Model A?" he said it could.

I asked him if he could make a sketch outlining briefly the simple scheme that he would—that he did have in mind.

Oberhoffen has recently been very ill, and his hands are very shaky. I can show you some correspondence that I have had with him, which I will produce after a while, or at some later date, if necessary. And, he requested me to have those drawings prepared, explaining to myself, and also to Mr. Brush, who was present at the time, just what conception he had, and we had Mr. Boesen make these drawings from the ideas which Mr. Oberhoffen had passed on to us.

The Master: Well, is he going to testify here?

Mr. Farley: Beg your pardon?

The Master: Well, is he going to testify here?

Mr. Farley: Yes, he is going to testify if the good Lord spares him.

I might state also in that connection, that I had hoped that we could have Mr. Oberhoffen here by the

end of this week. I communicated with him, however, and learned that he had had an operation within the last week or ten days and that his doctor advised him that it would not be very advisable for him **(1327)** to travel. And, I am afraid that we will have to take Mr. Oberhoffen's deposition at Rockford, Illinois. He is at Rockford, Illinois, and he is now working for the Ingersoll Milling Machine Company.

The purpose of having Mr. Boesen testify concerning these is because these drawings were actually made at the Ford Company under his supervision, to put down in graphic form the ideas about this matter which we will have Mr. Oberhoffen testify to later.

Mr. Spohn: Then, it may be understood that the testimony of the witness concerning these drawings, we reserve our rights with respect to it, until we hear from the gentleman?

The Master: Yes. I won't make any ruling on it until that time.

Mr. Farley: Yes.

The Master: Go ahead.

Mr. Farley: Yes. I thought that would avoid a lot of argument, that statement of mine about admissibility.

The Master: Yes.

Q. (By Mr. Farley): Now, Mr. Boesen, I show you the drawing, Exhibit 268, and will you please tell the Court what that is? A. No.

Q. Did you get the question? A. No.

The Master: Read it back.

Mr. Farley: Yes, read it, please.

(The question was then read by the reporter.)

A. Another idea of shaping the cams and the shaft.

(1328) Q. On what type of a shaft? A. On—let me see—this is the Model A.

Q. Now, just a minute, Mr. Boesen. A. Yes.

Q. This particular sketch that you have before you, I notice, shows a rather large shaft? A. Yes.

Q. That is not intended to represent any particular cam shaft, is it? A. Well, yes. That is a truck shaft.

The Master: A what shaft?

A. A truck shaft.

Q. (By Mr. Farley): A truck shaft, or a tractor? A. No—truck.

Q. What? A. No. Tractor—I think it is a tractor cam shaft.

Q. You think it is a tractor cam shaft? A. Yes.

The Master: Is that made to scale?

A. Yes, it is a scale—it is a tractor. I think it probably says here (referring to drawing)—no. It is a tractor cam shaft; it being built the same. No chance of getting the two started here or here (indicating).

Q. Now, when you say "here and here," you are pointing to the large end bearing? A. Yes.

Q. At the left-hand side? A. Yes.

(1329) Q. And to the space adjacent to the center bearing? A. Yes.

Q. At the right-hand side? A. Yes.

Q. Very well, now. Will you go ahead? A. Now, the working of this is so, that when we go this way (indicating)—

Q. (Interposing): Toward the left? A. Yes, to the left. And cuts this cam. Now, when this goes back, this changes (indicating respectively); so this tool (indicating) comes this way, alternating, according to which way you go, so that you cut both ways.

The Master: You have four tools cutting on one stroke?

A. Yes.

The Master: And the other four cutting on the other, is that the idea?

A. Yes.

Q. (By Mr. Farley): Now, insofar as that construction is concerned, the purpose of this drawing, 268, shows that you have four tools cutting, as you just said, in one direction, or one-half of a stroke? A. Yes.

Q. And the other four cutting the other half? A. Yes.

Q. So that in effect, this is a shaper, which, instead of cutting like the old Model T cam shaft shaper on one stroke, with a quick return, you are now shown a machine

which would cut both on what we call, we would call, the cutting stroke and the (1330) returning stroke of the old shaper? A. Yes.

Q. Is that correct? A. Yes.

Q. Now, insofar as that is concerned, did you in any way show in your drawings any modification of the driving means so as to affect the speed of travel? A. Yes, that would have to be different, because in the machine as it is now, it goes back much faster than it cuts. That would have to be made so that the speed of travel would be equal in both ways.

Q. I notice you have on the drawing this inscription—layout showing tools to cut in both directions, speeds being equal? A. Equal, yes.

Q. Now, will you state whether or not the designing of that type of a machine would present any greater problem than those with which you are regularly confronted with? A. Well, I think it would. I think it would require more mechanism.

Q. More mechanism than as shown in the drawings, 254 and 255? A. Yes.

Q. Or more mechanism than you have to employ in other machines which you design? A. No. What I mean is, more mechanism than what is in these—what there was in the old Model T shaper.

Q. Yes. Well, now, would the designing of the mechanism to effect the movements present any problem that would be beyond your ability as a designer? (1331) A. Well, if it can be made, we can make it. There is nothing to stop us.

Q. Well, now, in view of that last answer, will you state whether or not, in your opinion, this could be made? A. Yes, it would.

Q. And will you anticipate any great difficulties as to whether or not it would operate if it were made? A. Yes, I think it would.

Q. You think it would operate? A. Yes.

Q. Now, in connection with this drawing, 268, you also prepared a drawing, 269. Now, will you explain that? A. Well, this is part of this.

Q. "This," you mean 269? A. Yes.

Q. (Continuing): Is a part of 268? A. Yes.

Q. Now, just what is the job of the parts as shown in drawing 269? A. Well, this was merely to show a way of getting the tool back on the return of the shaft.

Q. Now, can you describe just what that particular mechanism is as shown in drawing 269? A. Yes. With this here turning (indicating)—

Q. (Interposing): Now, wait a minute. A. And this (indicating)—

Q. (Interposing): Now, wait a minute.

Mr. Farley: This will be off the record.

(There was a discussion off the record.)

(1332) A. Yes, this cam turning (indicating)—

The Master: Well, supposing we mark this with a "C," then, making a line here (indicating)?

Mr. Farley: Yes.

Q. (By Mr. Farley): Now, with the cam "C" turning, and the plunger "P"—put a "P" on the plunger. A. (The witness does as instructed by counsel.) Plunger is pulled out of its seat here (indicating), allowing this to go back (indicating)—

Q. (Interposing): Allowing which to go back? A. Allowing this tool to go back.

Q. All right. Now, let me start—"T" represents the tool, is that right? A. Yes.

Q. And "H" is the tool holder, is that right? A. Yes.

Q. Now, are those parts similar to the parts shown in the drawings, 254, 255? Are they the same type, generally, tool holders, as we have in this drawing? A. No. They would have to be a little different.

Q. All right. Now, explain the differences in the tool holder "H"? A. Yes.

Q. You have shown a slide or groove, which I will mark "G." A. Yes.

Q. Is that right? A. Yes. Now, let me see—if they—they could really—they could be the same. You see, you have a spring here (indicating) to hold the tool holder against the cam, the same as you have **(1333)** here (indicating). The difference in this is that over here (indicating)—let's see—we have a release of the cam, so that this (indicating) can be pushed up.

Q. Now, you stated that the tool holders here—you are referring to Exhibit 269—could be the same as the tool holder shown in Exhibit 254? A. Yes.

Q. And you stated that the cam has a release on it? A. Yes.

Q. You referred to the master cam to which I will put the letter "M"? A. Yes.

Q. Is that correct? A. Yes.

Q. Now, the master cam, "M," is similar to the master cams, "MM" shown in drawing, Exhibit 254, is that correct? A. No. No.

Q. Well, I mean except for difference in the contour of the work piece?

The Master: Let him explain what he means.

Mr. Farley: I see. All right.

A. This is really not worked out correctly. It is merely a sketch here to show how we would put the end of this, pull it back. That would be some other design in here (indicating). We didn't go to the trouble of putting that in. We just showed this here (indicating), that would put it back on the main, from the cam shaft, down here (indicating).

Q. I called your attention once before to a part, which, I said, (1334) was a groove, "G"? A. Yes.

Q. The tool holder would have a slide, or a groove-way extending horizontally toward the top part of it? A. Yes.

Q. As shown in your drawing? A. Yes.

Q. Is that correct? A. Yes.

Q. And, in that groove there is a plunger? A. Yes.

Q. "P," is that right? A. Yes.

Q. And that plunger is moved in and out of the groove under the influence of the cam, "C"? A. Yes.

Q. And now, the plunger has at its upper forward end, a wedge, or incline face, "W," is that right? A. Yes, it has.

Q. Now, then, as the master cam "M" rotates and comes to the flat portion of the cam, what would be the function of the parts? How would that work? You understand? A. Yes. This—the function of this (indicating)—

Q. (Interposing): That is "P"? A. Yes, "P" is to pull the tool back on the return stroke of this (indicating).

Q. Now, just how will that operate? A. This is not a finished design here. The sketch is only to show **(1335)** in what way the tool could be put back on the return stroke.

Q. Well, now, in the cam "C," I notice you have got one portion, which is a throw of the cam? A. Yes.

Q. And the throw is now shown in contact with a rod "R," which operates "P"? A. Yes.

Q. Now, when the cam "C," comes around to the lower part of its surface? A. Yes.

Q. What then would happen? A. It is pushed down.

Q. "P" would be pushed towards the right? A. Pushed down, yes.

Q. Under the influence of the spring? A. Yes.

Q. (Continuing): "S," is that the idea? A. Yes.

Q. And, then, what would happen? A. And this (indicating) would push over to the contour of this cam (indicating)—come over and do the work.

Q. What effect would that have on the tool holder? A. Well, the whole tool holder would be pushed over.

Q. The whole tool holder would be pushed over? A. Yes.

Q. What do you mean?

The Master: Well, if the plunger, "P" is pushed over this way (indicating), how would the tool holder be pushed over **(1336)** here (indicating)?

A. Right from here (indicating).

Q. (By Mr. Farley): Well, if you pushed the plunger "P" over to the right, would the tool holder stay in this position (indicating)? A. No.

Q. Or, would it move up, or would it move down? A. No. It would move over to touch the cam.

Q. It would move up? A. Yes.

Q. And what would cause it to move up? A. The spring here (indicating).

Q. The spring? A. Would push it over to the outline of the cam.

Q. Let's see, we will call that the spring, "Q"? A. Yes.

Q. And the mechanism shown by the cam, "C," is for the purpose of raising the tool, as I understand it? A. Yes.

Q. (Continuing): On the return stroke? A. Yes.

Q. And push the tool again down, in relation to the work on the cutting stroke, is that correct? A. No. No. No, it isn't. The idea of this is to push the tool over for the return stroke and letting the outline of that cam push the tool over. You see, this line would come over here (indicating), and, wherever outline is against that, could be pushed over to the contour of the cam.

Q. Now, when you say, "over," you really mean up and down, don't **(1337)** you? A. Well, all depends—if you mean horizontal—it couldn't be on the old machine.

Q. Yes, I see. A. That would be a whole new machine.

Q. And by "over," of course, the parts are shown vertically in the drawing? A. Oh, yes, yes. That would be the same thing.

Q. So, your "over" means up and down on the drawing? A. Yes.

Q. Is that the idea? A. Yes.

The Master: On the Model T shaper there was a device, was there not, for raising the tool holders as the shaper performed its return stroke?

A. Yes.

The Master: Is that a similar mechanism to what you have here?

A. No.

The Master: How is that?

Mr. Michael: The whole head raised.

The Master: Oh, the whole head raised.

A. Yes, the whole head raised for loading and unloading, and just a little bit forward it turns up, yes, and, there is a cam in here (indicating), running between those two rollers, and makes those two rollers go up and down.

Q. (By Mr. Farley): You are referring now to Exhibit 255? A. Yes. Now, those rollers are on a level with a fulcrum here **(1338)** (indicating). Now, as this cam runs around there and pushes this (indicating) up and down in there—but there, you get the mechanism to release the tool when the cam shaft goes back.

Q. Well, now, you are referring to rollers on Exhibit 255, and I will mark them "R." A. Yes.

Q. And can you mark the shaft or cam that operated those rollers—will you mark that, "C," in the Exhibit 255? A. Yes. "C"?

Q. Yes. A. (The witness does as instructed by counsel.)

Q. Now, would the cam, "C," in the drawing, 269, where would that be located with respect to the cam you have marked "C" in 255? A. You mean where this cam would be over here (indicating)?

Q. Yes. A. That would be this way (indicating) here.

Q. The cam "C," in 269, would be on the same shaft as the cam "C" in 254, is that correct? A. Yes. Yes.

Q. Now, with respect to the master cam, "M," in your drawing 269, that is to perform the function of governing the tool so as to get the contour of the work? A. Yes.

Q. Is that correct? A. Yes.

Q. Now, in that respect, would that cam differ from the cams, "M"? A. Oh, yes.

Q. I don't mean as far as the shape is concerned. I am talking **(1339)** about the function of regulating the tool so as to produce the contour. In this drawing 254, the cams "M" perform the function of raising and lowering the tools to produce the required contour? A. Yes.

Q. Is that true outline—this would have, only have it half the speed of that, because on this, we would have to have outline contour on this, as well as the space where this could act. A. Yes.

Q. But, as far as the function of performing the contour is concerned? A. We get that from the cam.

Q. You get that from the cam? A. Yes; master cam outline.

Q. Except that in this scheme such as you show in Exhibit 269— A. (Interrupting): Yes.

Q. (Continuing): —you would have to have an additional contour? A. Yes.

Q. (Continuing): To permit the raising them up? A. Yes.

Q. (Continuing): To get the cam, "C," to work? A. Yes, sir.

Mr. Farley: I think that is all.

Mr. Spohn: Did you offer those two last exhibits, Mr. Farley?

Mr. Farley: Oh, yes, yes.

I am offering now, Exhibits 269 and 268, and, in that respect, and, anticipating the objection, I might say it is **(1340)** quite agreeable with me if the Court withholds its ruling subject to the testimony being offered by Mr. Oberhoffen.

Mr. Michael: Well, may I ask, if counsel is offering these exhibits for setting up another standard of comparison?

Mr. Farley: No, we still have the same old standard of comparison.

Mr. Michael: What is the purpose of this?

Mr. Farley: To show the great ease with which any machine designer could avail himself of that to make Model A shafts.

Mr. Michael: But I thought the witness said it would take an entirely new machine to embody these features.

Mr. Farley: Just what did you mean by that, Mr. Boesen, that in making an entirely new machine you would make a machine which operated on a different principle, or on the same shaper principle as used in the old machines?

The Witness: Same shaper principle; the mechanism would be a little different—shaper principle.

Mr. Spohn: Well, do I understand, then, counsel, you state that this standard of comparison is set up in the account as filed here?

Mr. Farley: Yes, certainly, every bit of it.

Mr. Spohn: And the profits and advantages and gains have been computed along this comparison?

Mr. Farley: On shafts not restricted to this one, any more than restricted to the exact shape of the Model T cams or outline or periphery.

Mr. Spohn: Well, let me ask this, counsel: Do the costs there set up for the production of the Model T cam shaft in the account have reference to this standard for which these blue **(1341)** prints, Exhibits 268 and 269, have just been offered?

Mr. Farley: No. I would say no as to that. I would show after we form the basis for this—by the testimony of Mr. Oberhoffen, we will establish, in view of the speeds in the original machine that, using this type of machine, the modified machine as shown in these particular prints, we could have machined the shafts very much more rapidly as Mr. Pioch says in his testimony, by the use of the machine, using the shaper principle.

Mr. Spohn: Your Honor please, we haven't heard the testimony of the witness who is ill, and, in spite of that, I want to move the testimony of that other witness relating to the fact, to a machine not in existence at all, the whole matter is incompetent, irrelevant and immaterial and not a proper standard of comparison. It applies to both of the exhibits, if your Honor please.

Mr. Farley: Yes. I have been restraining myself with all of Mr. Spohn's objections concerning the standard objections of incompetence, irrelevance and immateriality. I am forced to admit that I am quite in agreement with him in view of the facts of this case, that all testimony concerning standards of comparison and numbers of cam shafts, will prove to be, in the end, entirely incompetent, irrelevant and immaterial.

I think I will show in argument later on, when we present it all to the Court, that it really has no part in the whole case, but, nevertheless, we are making our proofs concerning them.

It is a lot like a case I had before Mr. Sayres, if your **(1342)** Honor please, in which counsel for the plaintiffs, working on the basis of hoping to get a percentage, had endeavored to establish a cost of a dock, which was probably five or six times above the actual cost, and they did that by including everything that was in any way attached to the dock—railroad tracks, and all that sort of thing—and, along in my part of the case, the defendant, when I attempted to introduce testimony concerning the cost of railroad tracks, the objection was made by opposing counsel that it was incompetent, irrelevant and immaterial.

I agreed with the objection at the time. And I think that my argument here probably goes to the same general purpose.

Mr. Spohn: So, do I understand, then, that counsel agrees then that the exhibits are not competent, relevant and material?

Mr. Farley: Oh, no.

Mr. Spohn: I don't understand you.

Mr. Farley: I think it is quite material.

Mr. Spohn: I don't understand counsel's remarks. I thought he was agreeing with me. Maybe I misunderstood him.

Mr. Farley: I just want to call your attention to the fact as to how immaterial your case is.

The Master: Well, frankly, I don't understand your argument either, Mr. Farley.

Do you mean that all the testimony as to standards of comparison, that for some reason that you haven't yet argued or disclosed, is not in point, and that profit should be determined on some other basis?

Mr. Farley: No, of course not; of course not.

(1343) Perhaps my argument was a little bit on the facetious side.

* * * * *

The Master: Mr. Farley, in the defendant's statement of account, has **(1344)** any consideration been given to the extra costs of construction of these modified machines, and the extra difficulty from maintenance and repairs due to the additional moving parts and the extra operations which might be required, over the operations and costs in the original Model T cam shaper?

Mr. Farley: I think we have, your Honor.

I will say that matters of that type, that I have had sufficient mechanical training to appreciate and understand the manner in which the machines work, and, I don't think that that would seriously or materially affect the entire situation.

I can't conceive, knowing the type of construction that was in the Model T cam shaft shaper, that the addition of the extra slide which operates on the old well-known shaper construction, and many of which machines I personally have run, that we could, by any

means, get a condition of attempting to have or to keep those machines in operation, where anything like the number of maintenance and repair men could be required, as was actually required in the Ford plant to keep the Walcott machines in operation. And I will say that as far as this particular one we have just been talking about is concerned, we did not base any of our computations which we filed in answer to your orders heretofore on this particular type of a machine. If we use that, I think we would show figures very much more—decidedly more favorable to the defendant.

Does that answer your question?

Mr. Spohn: Do I understand counsel now to say that Exhibits 268 and 269 were not referred to, covered by the account?

(1345) Mr. Farley: They were not referred to by our statement of account. We were asked, at the request of the Master, or rather, the order issued by the Master at the plaintiff's request, to prepare a statement in debit-and-credit form, showing the profits, gains and advantages.

We were also asked to show and describe what standards of comparison, if any, we had used in the preparation and computation of that account.

Now, I can't conceive of how it could be possible that if we used certain standards there, we are precluded from still presenting other standards for the basis for which it was necessary to produce testimony to establish that such standards could or should be permitted as having been available.

I mean, if your Honor had said, "State all of the possible standards of comparison that the defendant might have used," then I could see that there might be some substance to Mr. Spohn's repeated objection as being a departure from the pleading, the state of the pleadings as they are. I can't see the pertinency of the objection myself.

The Master: We are getting into quite an extensive inquiry here as to the various ways which the cam shaft shaper might have been re-designed to perform the operation of rough-machining the Model A

cam shaft, and, not only going into the question of how it might have been so re-designed, but finding ways of re-designing it, so that it would have been a better machine than any machine that was ever designed by any company, or for any purpose in this field.

I am just wondering the extent to which we can go in a lawsuit **(1346)** in that direction. There must be some limitation to such an inquiry.

Do you consider that your statement of account which you submitted was primarily based on the re-designed cam shaper embodied in the wooden exhibit, which you have here, and that these other ways of re-designing a cam shaper, are simply to show that there were many other ways in which the cam shaper could have been re-designed, but which you did not definitely consider in your statement of account?

Mr. Farley: No. As to that, your Honor, I would say that in preparing that statement of account, and having the computations made, I considered first, the use of the old Model T cam shaft shapers with only the change of the master cams, with the slight modification of the cam shaft, which was well within the ability of the Ford Company designers, and was just as available to them as anything could possibly be, insofar as availability of machines are concerned; machines known and available to the defendant.

That is one.

Two: The slight modification, or the modification, whether it was slight or not—of the cam shaper, in the event that had the physical structures of the old Model T shapers still been in existence, the making of an attachment such as shown in the wooden model; paragraph three: If the Ford Company had had before it the necessity to—in 1927—which it did not have—to scrap the Walcott machines, and make a new machine, designing the new machine around the shaft in exactly the same way, and meeting exactly the same situation as they met when **(1347)** the change was made from the Model A to the V-8 with the Pioch machines; that then presents a number of expedients

clearly available to any competent designer, and any one of which might have been resorted to; one, the type described by Mr. Boesen and Mr. Pioch where the machines would be provided with two rams and the tools working in opposite directions, these four tools on each side, having very definitely considered also this particular modification, which I personally could say, presented no problem at all, or no great problem, which, I will say that with my limited experience in machine design, it was perfectly obvious to me, that, too, could be resorted to.

As far as the testimony of Mr. Oberhoffen is concerned on the subject, I consulted him at Rockford after we had filed our statement of account, and merely asked him the question, "Could you use the shapers on the Model A shafts?" He said, "Yes." "How could you do it?" He proceeded to outline his scheme, which I, too, had in mind, but, which I made no reference to him at the time, but which he personally had in mind. But that is one way he had in mind, had personally in mind when he was working at the Ford place. In fact, he had made lay-out drawings of this type of machine to increase the production of the Model T shapers. Before, however, that was ever completed—his layout—he was then transferred to another department.

So, I would say, then, that as to each and every one of them, they were taken into consideration and included in our consideration in our computation of our accounts.

Now, so far as this last one is concerned, if we had taken, **(1348)** based it on the speeds at which the original machines worked, we could readily have computed a very much greater rate of production, and a greater proportion of the—say—loss—by using the Walcott machines.

Now, as far as that is concerned, it is no more hypothetical than the hypothesis upon which plaintiff's entire statement of account is based. That, if you will remember, is based, first, upon the hypothesis that the Ford Company would be compelled to use the Landis grinders; and, then, with the further

hypothesis that some time study used in the White Company would have any application at all at the Ford place.

The Master: Well, I suppose, too, if you consult a hundred different mechanics and give them a good deal of time to think, they could think of all kinds of modifications which could be made in a design of almost any kind of a machine.

Mr. Farley: I would say, if the Court please, that if you would consult 100 different first-class mechanics and show them a Model T shaper, that you are quite correct, that each and every one of them might have a different suggestion, but, I don't think each and every one of them would require much time to think about it.

The Master: Of course, there is a practical question here as well as a legal question as to whether these modified exhibits are relevant at all, and that is the question of the extent to which the defendants should be permitted to put in cumulative evidence along this line. If you went into the question of, or completely analyzed the functions of each one of these suggestions of the ways of modifying the shapers to **(1349)** machine the Model A cam shaft, and, after considering the question of the mechanical practicability of the devices, then went on to the question of how the changes would affect the cost, and had direct testimony on the part of Ford Motor Company's witnesses, and, then, rebuttal testimony on the part of plaintiff's witnesses, and rebuttal testimony again, we will be in this proceeding almost endlessly here. I wonder how many more of these exhibits we are going to get into?

Mr. Farley: I think that is the limit, if your Honor please.

The Master: Is this the last one?

Mr. Farley: Yes.

Mr. Spohn: Is that the last one?

Mr. Farley: Yes, that is the last one.

Of course, we could get plenty more if we wanted to, but we won't, I assure you of that.

Mr. Michael: Well, your Honor, they could put in a car load of that. And, this last is just about the limit when they bring in a sketch of what somebody had in mind 15 years ago.

The Master: Well, I presume, then, again, there, that the assertion might be made that some of the hypothetical ideas which were thought of, looking back over the entire history of the different types of machines used, that would not have been thought by a man working at the Ford place, if he had a particular modification in mind, the time that this problem is presented that, then, that can't be charged to the product of a lot of experience which he has had subsequent to 1927 or 1928. So, there may be some point to that.

(1350) Mr. Michael: Well, I didn't understand that the man had it in his mind.

Mr. Farley: He had it long before that.

The Master: Yes.

Mr. Farley: He was considering it for the tractor camshaft, and he was moved out of the department.

Mr. Spohn: He was moved out of the department.

Mr. Farley: He was moved out of the department. He was promoted to personal designer of Mr. Ford for the period.

A Voice: This is off the record—can I speak?

The Master: Well, put it down, anyway.

A Voice: I was at Highland Park with Oberhoffen at the time he was transferred. That was when they started the tractor job. Now, what date that was, I don't know. But, I know Mr. Oberhoffen was put out there in charge of the designing, and we also transferred about six or eight draftsmen out of the department that was in Highland Park.

The Master: Well, if this evidence were simply being put in as cumulative evidence, and we are simply, or, it is simply a design or an idea thought up, I think we have already enough of those in evidence, and it wouldn't be necessary to have this one, except for the possible testimony of Mr. Oberhoffen on the point; consequently I will withhold ruling on it until the testimony of Mr. Oberhoffen is taken.

* * * * *

(1356) ALANSON P. BRUSH was thereupon called as a witness on behalf of the Defendant herein, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. You are a resident of Detroit, Mr. Brush? A. Yes.

Q. And, what is your occupation? A. Consulting engineer.

Q. Now, what experience, if any, have you had in connection with the automotive industry? A. I have been active in that industry since there was any to speak of. My first work in connection with the automotive industry was in the factory here in Detroit. They took a contract to build engines and transmissions for the Olds Company on their first production of automobiles. That was the first (1357) quantity production of automobiles in this country.

Mr. Michael: May I interrupt just a minute, just to raise this one question, as to whether or not Mr. Brush need give all the qualifications, and so forth, that he gave in the lower court.

Mr. Farley: I was just about to go into that myself.

Q. (By Mr. Farley): You are the same Mr. Brush who testified in the trial before Judge Tuttle? A. I did.

Q. You testified there you had experience running back to the beginning of this century, I believe it was, in the design of the first Olds' engines which were the first production job? A. The manufacture of them, and for production reasons, to adapt certain work pieces to certain shop methods. I did a little redesigning, which the Olds Company accepted, and which was incorporated in that product.

Q. And later you were with the Cadillac Company; then, with the Oldsmobile Company, wasn't it? A. No.

Q. Or, Oakland?

The Master: All of this is set forth in his testimony in the lower court; I don't think it is necessary to go over it again.

Mr. Farley: I don't think it is.

Q. (By Mr. Farley): Now, in connection with that work, Mr. Brush, you have had considerable experience in production methods, and with manufacturers in the automotive industry? A. Yes, I have had a great deal, and some in connection with the **(1358)** making of cams before there was any considerable automobile industry, in the shop work quite apart from automobile production. We have many uses for cams of various shapes, and very much more intricate cams than these that are here under discussion.

And, I have made, and seen made, cams for use in the shop by the shaper method, by the milling methods; so that I am very familiar with the mechanical problems involved in the production of cam form throughout a very wide range of shapes.

Q. Now, you were present here in the court room during the testimony of Mr. Boesen at the conclusion of the last session? A. Yes.

Q. You were also present during an interview I had with Mr. Oberhoffen some months ago? A. Yes.

Q. And, during the discussions with Mr. Oberhoffen, you recall that we requested him to make some suitable sketches illustrating a certain type of cam shaft shaper construction? A. Yes. As the result of some suggestions he made as to ways in which the shaper method could be applied to, and specialized for certain different work pieces than those that the original shapers were used on.

Q. And, Mr. Oberhoffen requested that in view of his trembling and shaky condition of his hands that drawings to illustrate that would be rather difficult for him to prepare at the present time, and requested that we have drawings made to embody the idea which he communicated to us. A. To illustrate an embodiment of that idea, yes.

(1359) Q. Now, you talked to Mr. Boesen, did you not? A. I did.

Q. And, I show you the drawings, Exhibits 268 and 269, and will ask you whether or not those drawings correctly illustrate and depict the idea described by—or, the type of construction described by Mr. Oberhoffen (handing documents to witness)? A. They do.

Mr. Spohn: Your Honor please, may it be understood this testimony is subject to our general objection.

The Master: Yes, I will reserve a ruling as to all this testimony. You may proceed.

Q. (By Mr. Farley): Will you explain to the Court the construction illustrated in these two blueprints, Exhibits 268 and 269, beginning with Exhibit 268? A. Your Honor will, I think, recall that it was pointed out that this Model T Ford cam shaft, and this Model A Ford cam shaft, the Model T being Defendant's Exhibit 34, and the Model A being Defendant's Exhibit 234, that owing to the designer's choice in designing the engine to provide the Model A cam shaft with enlarged bearings which would have a diameter large enough to include the span of the cams, that owing to that change in the work piece it was not feasible, without change in the work piece, to use the shaper method of roughing these cams preliminary to case hardening and grinding on the Model A shaft on the shaper, with all of the tools cutting in one direction; that owing to the smaller bearings on the Model T, it was possible to shape the cams with all of the tools cutting in one direction, and that was done.

(1360) Now, Mr. Oberhoffen's suggestion was that since certain of the tools that would have to cut away from one of these large bearings, since those tools could not back up and get in position to start the cut on account of interference with the large bearings, certain of the tools would have to cut in the opposite direction, and Mr. Oberhoffen suggested that since certain tools would have cut in the opposite direction, the natural thing for a tool designer, from his standpoint, would be to just reverse half of them, so that half would cut in one direction and half in the other. So, he suggested that a sketch should be made illustrating that reversal of half of the tools, and a further sketch illustrating an alteration in the embodiment of the method in the shaper, so that half of the tools could be lifted for a return stroke while the other half were cutting, and, conversely, that the other half be lifted while the first half of the tools were traversing and cutting, traversing their cutting stroke.

I don't know whether your Honor recalls or not, but the lifting of the tools where they all cut simultaneously in one direction was done in the original shaper by lifting the master cams and the tools as a unit. The whole thing

was cammed up and down in synchronism, with the cutting stroke in one direction and the return stroke in the other.

Mr. Farley: Just on that point there, I don't know that any of the prior witnesses did describe that mechanism completely to you; did they?

The Master: Not in detail, I don't think.

Q. (By Mr. Farley) I think at that point you might refer to the drawings, I think, Exhibits 254 and 255 (handing the drawings **(1361)** above referred to to the witness). A. The master cam shaft, which I am indicating on Exhibit 254, is shown here at the top with a driving arrangement off the vertical spline shaft through a worm wheel, and those master cams and the tool slides are all on a slide unit, and can move vertically, and that slide unit, the whole unit, is cammed up and down in synchronism with the cutting and return movement of the work piece, so that all of the tools are lifted at their return stroke.

The Master: Where is the cam shown on the drawings?

A. Now, on this drawing, Exhibit 255, it is shown in dotted lines, a pair of rollers that span a cam, and also shown in dotted lines, and those rollers are pivoted on an axis shown over at the left.

Mr. Farley: The rollers are marked "R" in lead pencil on the sketch.

The Witness: That is right.

Mr. Farley: Maybe it would be a good idea to mark the pivot there of the rollers.

A. (Marking exhibit.) And that pivot carries an eccentric—not clearly shown in detail—that eccentric moves the slide carrying the master cam, and the tool slides up and down for moving the work.

Q. How about the cam that actuates the two rollers "R"? I call your attention to the part marked cam "C"? A. Well, it is not very clear there. There are a number of pieces superimposed here, and the cam contour is not very clearly shown, although the action of the mechanism in doing that is clearly understood, but to pick out the details and show **(1362)** the cam contour,—that is the

operation, and that takes the place, that mechanism, for lifting the whole group and returning it to the cutting position on the work, is a substitute for the ordinary clapper box, as it is called, that is used on planers and shapers, and I might interpolate that planer and shaper to the shop man and tool-maker merely designates a difference in two tools, in structure—that is, the planer, as we ordinarily speak of it in the shop, is a tool of the same,—machine tool of the same type as the shaper, except in the planer the work piece moves under a tool, and in the shaper the tool moves over the work piece. In each machine there is simply a relative movement along the line of travel between the work piece and the tool. And, on the return stroke in each, the ordinary practice is to permit the tool to lift by a hinged construction, so that it can swing up out of the way of the work and not interfere on the return stroke. So that, so far as method of of machining is concerned, planers and shapers are embodiments of the identical method of machining.

Now, this so-called cam shaper in ordinary shop nomenclature would be called a planer rather than a shaper, although the method practiced is identical in both. It is a cam shaping machine in a sense that it shapes the cam, produces the shape of the cam desired for the cam preliminary to case hardening and grinding.

This original embodiment of the shaper method of profiling cams has the ordinary crank shaper movement in it, which is a swinging Scotch yoke.

I don't know whether your Honor will recall the old **(1363)** steam fire engines that we had before we had gasoline fire engines. They had a normal Scotch yoke for maintaining the rotating relationship between the reciprocation of the pistons and the crankshaft. The ordinary engine uses a connecting rod between the piston, or a crosshead, and the crank, and that gives the modified sine movement, the sliding Scotch yoke gives a true sine movement, and shapers in the shop, many of them, use the Scotch yoke; that is to say, a crank pin journaled in a block which slides in a parallel yoke, only in the shaper the arc, in place of sliding back and forth, swings, and that gives the quick return movement. That is to say, when the crank pin traverses the arc, which swings the pin adjacent to the pivot of the yoke, because the leverage

is shorter, that gives the quick movement, and when it traverses the arc which brings the crank pin away from the pivot of the yoke, this gives a slower movement, and that gives a quick return movement.

Q. Suppose you mark the yoke there with a reference character "Y." A. I will draw a pair of reference lines from the extreme end of the yoke bars.

Q. The extreme lower end? A. Yes, and run those two reference lines to a letter "Y," and the crank pin, I will indicate with a letter "P" right on its center.

Q. You have two "P's" on the drawing now. A. Well, I will take the letter "K" (marking upon the exhibit), and the block which slides in the yoke I will indicate by a letter "B."

(1364) Mr. Farley: The witness has made all those reference characters on the Exhibit 254.

The Witness: Now, I spoke of that swinging Scotch yoke.

Mr. Farley: You understand that principle?

The Master: I have a general idea of it. I don't know whether I could actually make a model of it.

The Witness (Continuing): I spoke of the swinging Scotch yoke, and the fact it was in common with all shapers—I mean tool-room shapers in ordinary shop practice—because Mr. Oberhoffen said, of course, if you are going to make the shaper cut in both directions, you wouldn't want the quick return movement. So, he said what he would do in place of using the swinging Scotch yoke, he would use an ordinary sliding Scotch yoke. That is, attach the bars of the yoke, side bars of the yoke, directly to the slide, and let the block slide in the yoke formed by these two side bars, and the crank pin journaled in it.

And, the sketch Exhibit 268 shows a diagrammatic illustration of that movement, which gives movement of equal velocity in both directions.

Mr. Farley: Suppose you mark on sketch Exhibit 268 "K" for the crank, and "Y" for the yoke.

A. (Marking same on Exhibit.) I put a "Y" on each bar of the yoke.

Q. (By Mr. Farley): The yoke in Exhibit 268 is what we would term a depending lug or bracket coming down

directly from the bed of the machine? A. Directly, not from the bed of the machine, but from the slide which carries the work piece.

(1365) Q. That is right. A. So that the movement of the yoke would be a movement of the slide carrying the work piece, and consequently a movement of the work piece.

Q. That is, the reciprocating slide. Suppose you mark the slide, reciprocating slide on Exhibit 268, with the reference character "S."

(The witness thereupon marked the exhibit.)

Q. All right. A. I have marked the left-hand end of the work carrying reciprocating slide with a capital "S." Now, since the half of the tools must be lifted on your embodiment of the cam profiling or forming method, while the other half are down, I asked Mr. Oberhoffen what type of lift he would suggest for that, and he suggested the very obvious expedient of simply shortening the distance between the master cam and the cutting point of the tool on the return stroke.

You see, on the original shaper there was a spring which held the tool slide up against the master cam, so that the master cam could move the tool up and down to produce the profile desired of the cam. Now, obviously to a mechanic, it is a matter of pure designer's choice whether you would move the master cam and with it the slides for the return stroke, or whether you will simply shorten the distance between the point of the tool and the master cam on the return stroke. They both will accomplish the same thing, namely, lifting the tool away from the work on the return stroke. So that, at Mr. Oberhoffen's suggestion, I had the illustrative sketch, 269, made up, which shows a cross-sliding wedge member **(1366)** actuated by a suitable cam which will push the wedge to the left to bring the length between the tool point and the master cam the amount which will correspond to the desired profiling of the cam and which, by movement to the right, will permit the lifting spring on the tool slide to lift the tool as much as the wedge member permits. And, in that way the tools can be lifted off the work for the return stroke just as they were in the original, except in this case each tool has its own cam to control its lift to clear the work;

and, by fitting half of these cams so that the desired half of the tools are down when you want them to cut, and the other half of these cams, 180 degrees around on the cam shaft, why, you have the desired lifting of half of the tools for one return stroke while the other half of the tools are cutting, and vice versa.

Q. Now, I notice, Mr. Brush, Mr. Boesen, when he was testifying, placed a number of reference letters on the drawing, Exhibit 269. I wonder, now, if you would, by referring to those reference characters, explain to the Court just what the operation would be on one stroke of this tool "T" as shown in Exhibit 269? A. Yes.

Q. With the parts in the position as shown now, the parts are now in the position for the tool to be in its cutting, lowered cutting position, is that correct? A. That is correct.

Q. Very well. A. Your Honor will appreciate that the method of producing a desired cam profile by a shaper or planer has nothing whatever to do with the number of cams you are producing. As you **(1367)** increase the number of cams, you simply repeat the practice of the method for each cam. The method has to do and may be practiced on a single cam, or there may be any desired multiple of the practice of that method incorporated in any one machine or fixture. So, as Mr. Farley suggested, it is sufficient to describe the action of one tool, and that then describes precisely the action of any other tool, or all other tools that are performing the same functions at the same time.

In other words, if I describe the action of this tool I will be describing the action of the three others, which make the set of four.

Now, this sketch shows the lifting cam "C" in position to give the proper full extension of the distance between the rider on the master cam, and the point of the tool, so that work piece traveling under the tool will be cut by the tool down to the profile contour desired on the cam. When that stroke has ended, as it will end when this cam "C" is a quarter of a revolution further, then the roller, rider "R_1," which is mounted in the rider "R" will move backwards under the urging of the spring "S" following the contour of the cam "C."

Q. By "backwards," you mean to the right in the drawing? A. To the right. The wedge member "S" will move backwards.

Q. Wedge member "W"? A. Wedge member "W," under the actuating force of the spring "S," will move backward a distance corresponding to the throw of the cam, and that will permit the spring "Q," the lifting spring of the tool slide, to push the slide up until the cam rider "Z" is again in contact with the wedge member "W."

(1368) With the wedge member in a position moved to the right, that shortening of the distance between the point of the tool and the cam rider permits the tool to be lifted out of engagement with the work by the spring "Q" for the return stroke. It is just one of the very many designer's choices as to how you will lift a tool on a shaper or a planer on the return stroke preliminary to a succeeding cutting stroke.

Q. Now, is there any mechanism at all similar to the spring "Q" in the drawings, and in the shaper, as originally constructed in accordance with the drawings 254 and 255? A. Oh, yes, the same spring is there to lift the tools. This spring "Q" for holding the rider against the master cam is also shown on this drawing, and I will draw a reference line there and put a letter "Q" on that. That is the same spring for the same purpose, namely, of holding the rider of the tool slide against the master cam at all times.

Q. I note now, Mr. Brush, on the drawing, Exhibit 254, that there are a number of cams which have been marked with the reference character "M." Do you see that? A. Yes.

Q. Now, is there any similarity between the cam shown here and the cam "M" as shown in Exhibit 269? A. Oh, there would be no reason for any dissimilarity; let us say, except this is an illustrative drawing, this drawing 269, it is intended to illustrate the identical master cam that would be shown in Exhibit 254 if the work piece in each case were the same. So, the master cams used with either methods of lifting the tools for the return stroke would be identical if the work piece was identical.

(1369) Your Honor understands that each work piece must have a master cam which has a proper functional relationship to the contour of the cam to be made.

Q. Now, I think for clarity, Mr. Brush, it might be well to take this Exhibit 268 and mark each set of tools. I think in the original drawings, or rather, in sketch 269, we have marked the tool "T," and I suggest that you mark the tools "T" on drawing 268, which would cut in the same direction as the eight tools on the old Model T shaper. A. Your Honor, by looking at this drawing, Exhibit 254, you can see that these tools have a clearance angle on the bottom going upwardly and towards the left, which indicates that the tool cuts with a movement to the right. Consequently, the four tools in the sketch 268, which correspond in their cutting stroke to the eight tools in the original embodiment of the cam shaper, I will indicate by four letter "T's." (Marking same on Exhibit.) And, the set which have been reversed to cut in the opposite direction, I will indicate by a similar reference, similar reference lines drawn to the left from them and mark those "T_2."

Q. Now, Mr. Brush, I think it might be well in view—is there anything here which indicates those tools which would be up or down, this particular sketch 268? Suppose we do this, consider the four tools "T," and that the shaper is now getting ready to make a cut, perform the cutting stroke. In what position would the cam "C" be at that instant? A. The cam "C" would be in a position 90 degrees from that shown on drawing 259. That is to say, this drawing 268 shows the position of the tools just at the end of a cut of the set of **(1370)** tools "T_2." That is, they are shown just having finished their cut.

Now, that will be at the moment when tools "T_2" will be lifted and tools "T" will come down preparatory for their cut. So that, the position shown on 268 would correspond to a position 90 degrees from that shown on 269. For the purposes of illustration, drawing 269 showed the wedge in, and the tool down to the contour of the cam.

Q. Now, as far as the operation of the shaper is concerned, and the shaper principle, what have you to say as to whether or not the machine of the type shown in the drawings, 268 and 269, follows or departs from the original machines as shown in Exhibits 254 and 255? A. The method of producing cam shape, or contour, or profile is identical. The embodiment of the method has been varied, as every competent machine tool designer and machine tool

fixture designer must know how to do, how to adapt a method to a different work piece. That is the competence which makes a machine tool designer, or a machine tool fixture designer. It is the ability to take a proven method, and it is still simpler if there is a proven embodiment for a different work piece that has been specialized to one work piece, and re-embody the same method in a machine tool, or a machine tool fixture, so that the same method can be practiced with maximum efficiency on a different work piece.

That is what machine tool designing and machine tool fixture designing essentially consists of. We design special machine tools—and, I will say that the Ford Company was the pioneer, in this country at least, and I think in the **(1371)** world, in having machine tool designers build machine tools where the whole machine tool was specialized to a single—very often a single operation, on a single work piece.

Now, in the old days much, if not most, of our production was done by taking machines that were more universal in their application to a wide range of work pieces and providing them with fixtures or attachments that were specialized. But, the Ford Motor Company went further when and after they initiated the production of Model T, and established a practice, where efficiency demanded it, of designing a whole machine tool around a work piece, or, perhaps, a single operation on a work piece. So, for, let me say, from the early days of the production of the Model T car in the automotive industry, it has been a regular practice, and in a way a measure of the competence of the machine tool designer, his ability to take a proven and embodied method of operating on one work piece, and designing either a whole machine tool, or a special machine tool fixture, to apply that method to a different work piece.

Q. Would you say whether or not the shaper, the Model T cam shaft shaper, as shown in these Exhibits 254 and 255, is an exemplification of that designing of a special machine around a work piece to do a particular operation? A. Yes. It is a perfect example, because there is a machine tool which was so highly specialized that any considerable change in the work piece takes it out, entirely out of the range of that machine as built; but that, of course, is not

to say that it takes the method out of the range of a wide variety of work pieces, because that simply requires normal competence **(1372)** on the part of the machine tool designer. Take that method with that proven embodiment, and simply make another embodiment of that method, which other embodiment is specially adapted to the desired other work piece. That is routine.

Q. What would you have to say as to the availability to the Ford Company, let us say, in 1924, of the use of a construction such as is shown in Exhibits 268 or 269?

Mr. Michael: Your Honor, I hardly think this witness is qualified to say what was available before 1924.

Mr. Farley: I think he is quite qualified, your Honor please, as an experienced man, knowing machine tools, and things of that kind.

The Master: Well, I think he would be qualified to express an expert opinion on whether the modifications here are something that have developed subsequent to 1924, or whether they were pretty generally known at that time. I will overrule the objection.

Read back the question.

(The last question was thereupon repeated by the reporter.)

A. Of course, it was just as available then as it is today. These sketches do not show a single mechanical principle, or type of device that wasn't generally known to mechanics long before 1924. Given the record of the shaper embodying the method for one work piece, given the new work piece, and the desire to re-embody that method in another machine tool specialized, there is no problem at all, and that is only one of a half dozen different ways of adapting the shaper method to that particular work piece, type of work piece.

Q. We have here, Mr. Brush, a cam shaft, Defendant's Exhibit 35, **(1373)** which was introduced in the trial before Judge Tuttle, and which is one of the Fordson tractor shafts. Will you compare that with the showing of the cam shaft on this Exhibit 268, and state what particular type of cam shaft is shown in the Exhibit 268? A. Well, the illustrative blueprint, 268, is drawn around this particular work piece. That is to say—

Q. It shows the same spacing of the cams, the same spacing of the bearings, and the same relative diameters of bearings to cams? A. That is right. It was by my instructions it was drawn to illustrate a set-up of tools for that shaft.

Q. Now, as far as the action of the cutting tools in performing their cutting stroke, would the tools "T" perform their cutting action in any different manner in the showing of Exhibit 268 than they would in the original? A. Certainly not.

Q. Now, how about the tools "T_2"? A. No difference there. They are doing the job of a shaper or a planer tool getting down to the desired depth of the cutting stroke, raised for clearance on the return stroke. That is all there is to that. And, that is just as old as planers and shapers in general.

Q. How about the difference between the construction of the Scotch yoke, as you termed it, originally, as shown in Exhibit 268, as compared with the one shown in Exhibits 254 and 255, the old model T shaper? A. The action in the yoke or crank and the block is the same. The yoke in this case is a true Scotch yoke, having a straight reciprocating motion at right angles to the bars of the yoke.

(1374) Q. And, would your true Scotch yoke shown here function in any different way otherwise than with respect to the speed, modifying the speed of the reciprocations? A. Not at all. The swinging Scotch yoke is used on shapers and has been for a great many years, to give a quick return where cutting is only in one direction.

Q. Now, how about the action of the cam "C" in Exhibit 269 for raising or permitting the raising of the tool holders by the spring "Q"; to what extent, if any, does that modify the principle of operation of the parts in the original machines? A. That doesn't modify it at all. It is just an alternative, and certainly a designer's choice, alternately, of a way to lift the tool on the return stroke so it won't drag.

Q. But, in this particular type of construction, drawing Exhibit 269, you have to have, as I understand it, eight cams, one for each of the tools? A. That is right.

Q. And, how does that compare with the original machine? A. On the original machine, only one cam was

used, and that lifted the whole battery of eight tools for the return stroke, and moved them down for the cutting stroke.

Q. Before discussing this matter with Mr. Oberhoffen, had you personally considered the proposition of reversing four of the tools on this shaper? A. Yes, sir.

Q. And, did you have any particular conception of any means for doing it yourself? A. Oh, I think I should probably have used, in place of a wedge, if I had not been taking Mr. Oberhoffen's suggestion, I should **(1375)** probably have used a broken toggle in there to vary that length controlled by a similar cam. Again, it is just a designer's choice, just which construction he chooses to use.

Q. Were you particularly impressed at the time—state whether or not you were, with the suggestion of the wedge by Mr. Oberhoffen as being something unusual, let us say? A. Not at all. It is simply one of the many ways of doing the job, and it is just one of the several ways of doing it that any designer would consider before he constructed the machine. He would pick out the one he thought to be most durable in action, not too expensive to build; he would simply exercise what we engineers call a designer's choice, and use the one that he personally liked best.

I will say this, that I have many times had occasion to give to machine tool designers the embodiment of methods in fixtures for machine tools. I never yet gave two designers the same work piece and the same method to embody and got identical embodiments for two of them. There will always be a sufficient variety of choices available to any competent designer. It would be a strange thing, indeed, if you gave a problem to two independent draftsmen who were reasonably competent fixture designers and got identical results from the two of them. It just doesn't happen. There are too many choices.

Q. Now, when you were mentioning the proposition of the Ford Company, I think you said was the pioneer of the special machine, you said that prior to that time it was more or less the practice to take a standard machine, such as could be purchased on the open market, and to make attachments for **(1376)** them. Did you have in mind any particular construction that you know of that would be illustrative of the standard machine ~~production~~ attach-

ment for a special job? A. I think your Westinghouse machining method embodiment is as good an example to get to put that on a standard production lathe.

Q. There has been quite some testimony and discussion in connection with steady rests, and I wonder if you would mind explaining the function of a steady rest such as used in these shapers, such as is shown in Exhibits 254 and 255 and the steady rest as used, let us say, in the Walcott machines? Incidentally, you are quite familiar with the Walcott machine? A. Yes. Your Honor will understand that in any cutting tool there are two reactions between the tool and the work piece. I am now speaking of a cutting tool that moves along a desired path with respect to the work piece, and in moving along that path removes metal.

One, the tool will try to back out of the work, and the amount of the force with which that tries to back out of the work will depend somewhat on the sharpness of the tool, and the form in which it is ground. But, there will be some force tending to back the tool out of the work,—not much with a properly-ground tool.

Then, there will be a very substantial force of reaction between the tool and the work piece to produce the cutting movement between the two.

Do you follow me?

Now, on the lathe and shaper, those forces behave very **(1377)** differently, and when I say "shaper" I like to have you understand I am including shaper or planer, because it doesn't matter which piece moves.

Now, on a lathe the greater force necessary to propel the tool through the metal acts tangent to the surface of the contour being cut.

Q. At the point where the tool engages the work? A. Yes. Let me illustrate that, if I may, by a sketch, which I will use, the simple round form.

Q. Just a minute, Mr. Brush, I think we have some sketches already in evidence that probably we could use without adding more sketches to the record. I don't think it makes much difference. No, I think we won't; go ahead and make your own. A. (Drawing sketch) This is very simple. Now, if I indicate a tool at "T," and draw a dotted line outside the work piece to indicate the depth of cut, and I set the thrust reaction between the

tool and the work piece, so far as the pressure necessary to make the cut is concerned, that is a force which tends to move the work piece in that direction, indicated by an arrow, and tends to move the tool in precisely the opposite direction, every action and reaction being equal in nature.

Q. Suppose you put a "T" for "tangent" on that first arrow. A. Well, I will indicate that by "Tan."

Q. All right. A. Now, there is also a reaction, as I told your Honor, but a very much less one, tending to force the work piece away from the tool, and tending to force the tool away from the work piece.

(1378) If we assume on this illustrative sketch that I have drawn these first indicating lines representing the magnitude of the forces, then I may complete the parallelogram of forces and draw a resultant line, which resultant will indicate the direction, and relative magnitude of that resultant force as compared with the other two forces; that is, the first two forces acting simultaneously produce the resultant, and there will be a resultant, backward force on the tool, in exactly the opposite direction.

Now, your Honor can see that in a lathe, the tendency of the cut, of the force which is necessary to make the cut, tends to spring the work piece sideways; that is, to bend it. And, that force will be modified by the force necessary to keep the tool in, as I have indicated, and will have a resultant force.

I am simply duplicating the first parallelogram.

Now, in the Walcott machine, this tendency to bend the work is resisted by a rider on the work called a steady rest, which is placed approximately so as to resist this resultant force. Do you follow me?

The Master: Yes.

A. (Continuing) Now, let us see what will happen. If a work piece, such as Exhibit 234,—

Mr. Farley: Incidentally, that being the shaft that was turned on the Walcott machine.

A. (Continuing) —be bowed so that when it is revolving on the centers in its end, this enlarged center bearing will run eccentric, let us say, .020 of an inch. That figure has been mentioned; it will do for the purposes of discussion.

(1379) Your Honor will see that if the—if you could imagine the tool infinitely sharp, and the material cutting with infinite ease, and you turn this cam as this one on the left, or this one on the right of that center bearing, the base circle of that cam would be displaced .010 of an inch from the true center of this cylindrical center bearing. Do you see?

The Master: Yes.

A. (Continuing) All right. That would mean that when you hardened this cam shaft, and attempted to grind it, you would have a .010 displacement from the cam to the center bearing. If you ground the cam so you took a uniform cut off of them to finish them, you would have an unnecessary and excessive amount of stock in order to clean up the center bearing. So, it is desirable in shaping these cams, I mean roughing them to the form to be ground, that the roughed cam have its desired center of rotation coincident with the desired center of rotation of the center bearing. That is necessary if you are going to have production efficiency on these grinders and not have it case hardened very deep to allow for these errors.

Q. By "shape of the cam" you are referring to the shape of the cam by a turning operation? A. Yes. So far I am discussing the turning operation. Presently I will compare this with the shaping or planing method of giving you a desired profile.

Now, your Honor will see that even if we have some force necessary to hold the tool into the work, which we do have, supposing this shaft would be bowed, this force to hold the **(1380)** tool in would be about the same in all directions, even though the work piece is crooked. Consequently, although the work may spring somewhat under that force, it will spring alike, and still, even though there are forces, we will get this same displacement area. Do you see?

Now, when you take steady rests, which simply resist the thrust of the tool sideways to bend the work, it still permits the error in the work to reproduce itself, and in that Walcott machine, if the work be .020 crooked, there will just be a .020 error in the placement of the cam contour. This type of steady rest does not resist movement of the work to and from the tool. It is put there to carry

the heavy load of these resultant forces. And, if you took the tool away, and put a crooked piece of work in there under that steady rest, and rotated it, it wouldn't move up and down toward the steadying roll, but it would move sideways toward and from the tool, just as though the roll wasn't there. So, it was necessary on this Model T shaft, for example, when turned in the Walcott machine, to have the shaft straight, within the permissible limits of error of grinding after case hardening.

Now, let us take the shaper method, and—

Mr. Farley: Before we leave there, I think we will have the first sketch, the sketch just made by the witness, marked Exhibit 272.

(The document above referred to was thereupon marked Defendant's Exhibit 272 by the reporter.)

A. (Continuing) Now, on this first sketch I showed diagrammatically and illustratively the kind of force you are dealing with in (1381) lathe work. Now, I want to follow the same analysis with the tool forces on the shaper or a planer.

Now, in that case, in place of cutting around it, you cut along it, along its parallel elements. We say the form of this kind have elements which are parallel to the axis of rotation, and the shaper or planer cuts along these elements so that when I illustrate a tool, or a work piece for profiling on a shaper or planer, I must now draw a work piece looking at it sidewise, and I will put my dotted line to indicate the amount to be removed above, and I will indicate a similar tool above that.

Q. (By Mr. Farley) Suppose there, Mr. Brush, you extend your work piece a little bit, so that this part would indicate a cam, and to the right, and the recess portions between the cam. A. And, I will draw a line indicating a center line, which I will mark, "C. L." Now, then, your Honor will see that we have the same forces of reaction between tool and work. That is to say, we have our major force acting along this line, the tool tending to push the work to the right, and the work tending to push the tool to the left.

Q. This line you just mentioned, this line I think you better give it some sort of a designation. A. I might mark that "C. F.," cutting force.

Q. And the other line? A. The other line, the lesser force necessary to hold the tool into the cut, I might call—

Q. (Interposing) You have drawn a vertical line; the first one was a horizontal. **(1382)** A. That is right. I might indicate that force line as "R.F." or radial force.

And, again, we get a pair of forces which act—a complete parallelogram of forces, and draw a resultant, so that the reaction of the tool on the work tends in the shaper to force the work down by the magnitude of the radial force, and the cutting force tends to force the tool—force the work along its axis. But, there that major force is resisted by the mounting of the work. There is very little tendency to bend the work, because the cutting force is resisted by the mounting of the work piece axially so that when, as in the shaper, an embracing steady rest fitting on the underside of the work piece was used—

Q. (Interposing) You have drawn it under the cam instead of the recess portion. A. I have just drawn some lines in here which I will call "S.R." for steady rest.

Q. Just a minute, Mr. Brush, don't you think you better make your steady rest in the recess portion rather than on the cam? A. I was thinking for a moment of a round piece, but that is immaterial. We will treat this as a cam, and now the steady rest might be on the center bearing, or it might be between the cams. The center bearing is a convenient place, and I might amplify this sketch a little bit, and show a center bearing in here alongside of the cam.

Now, then, a steady rest under this center bearing, and particularly one which fits that through a considerable arc, extends up here.

(1383) Q. You have marked the part indicating steady rests, "S.R."? A. Yes. And, we will mark this part, "C.B." for center bearing.

Now, your Honor can see that so long as this force tending to force the tool out of the work, so long as that has magnitude enough to spring the work down against the steady rest, regardless—up to that limit—regardless of how much that piece may be bowed, the cam formed will be cut concentric with the axis of rotation of that center bearing when running in the steady rest.

Now, the boys were right that they needed to restraighten and keep those pieces straight for the Walcott

machine. It wasn't a question of whether they had one or three steady rests; the type of steady rest used on the shaper, and the type of cut, and the type of machine, made the shaper automatically correct, and completely correct, all bowing of the work up to an amount of bow and stiffness that would hold the work away from the steady rest against that radial force of the tool.

Now, then, even if that radial force of the tool were not sufficient to hold the work clear down to the steady rest, still the error would be much less in a shaper than in a lathe with the steady rest of the type used by Walcott, because if this radial force didn't exist at all, you can readily see that if this work were bowed .020, that means when the bow was upward, it would stand normally .010 away from the steady rests, and when it turned over it would try to go .010 below the support of that steady rest, but couldn't. Consequently, with a .020 bow in the **(1384)** shaper, as the radial force had no effect at all, it would only have .010 there instead of .020, just half; whereas, in the Walcott lathe as built and used, the bow of the work piece will reflect itself practically 100 per cent in error between the concentricity of the cam formed and the center bearing.

Q. What would you say, Mr. Brush, as to the possibility of the tools in the shaper with the model T shaft, which we have before us, as they performed their cutting stroke, pressing the shaft down against the steady rest? A. The radial force of the several tools cutting simultaneously on this model T shaft would be very much more than sufficient to hold the shaft to the steady rest, as much as a .020 eccentric; that is, a .020 of an inch bow.

Q. How about .030? A. Well, it would depend on the sharpness of the tool, and the form they were ground. .030 would only require .015 bending of that, and I think I could do that much with my thumb. Certainly .020 error would wash out completely, and .030,—well, if .020 will wash out, you might have .017 of error; whereas, on the Walcott you would have .030, if you had that bend.

Q. Now, would that action you have just been describing be any way influenced or modified by the number of steady rests that were used on the shaft and the shaper? A. No.

Q. Now, how about the Walcott machine, would it in any way modify the necessity for a straightening operation of the shafts in the Walcott machine if one were to use, say, **(1385)** three or four steady rests? A. Not a bit. Steady rests of the type used on that Walcott machine would still permit the bowed error to reflect itself in the tool work piece.

Q. There was a question, a certain showing in the record on appeal, shown to Mr. Pioch when he was on the stand, and that was one thing I inadvertently neglected to ask him a question on, on re-direct examination. I direct your attention to the showing in Plaintiff's Exhibit 41, to which Mr. Pioch's attention was directed, and how many steady rests does that show there? A. That shows four steady rests, and, your Honor, by counting the number of heads which you can see indicated here, I gather that that is a Walcott machine set up for a line 8; that is, there were approximately 16 cams on there; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16.

Now, because the steady rests there have to resist the cutting force, or cutting reaction, they need four steady rests on that, but if those steady rests are of the type on the Walcott machine at Highland Park, they will still have just as much need to see the work piece is straight in its free position as though they had one. The cutting force is very considerable, and you take a long line eight shaft, if you didn't have a steady rest to resist the cutting force, you would bend the piece until it jumped out of the machine, because, as I tried to make clear, and hope I did, in the lathe the cutting force tends to bend the work piece; in the shaper or planer, the cutting force merely tends to move the work piece axially, and is resisted in compression by the work piece with no tendency to bend the work piece except **(1386)** for the radial force, the amount of force necessary to keep the tool into it at its desired depth.

Mr. Farley: I offer the second sketch made by the witness, or, rather, ask that it be marked Exhibit 273.

(The document above referred to was thereupon marked Defendant's Exhibit 273 by the reporter.)

Mr. Farley: And, I offer Exhibits 272 and 273 in evidence.

The Master: I will admit these exhibits as supplementing the testimony of the witness.

* * * * *

(1402) Q. Now, in that connection, Mr. Brush, this hump on the work of the shaft, Exhibit 234, in the sixth cam, you were just referring to, would the sharpness of the nose of the cam, or bluntness of the nose, let us say, in any way affect that general proposition? That is, would the likelihood of the error occurring be more pronounced in the sharp nosed cam or in what we would term a blunt nosed cam? A. Well, of course, we might put it this way. If you had no cam form at all, then this overhead will be a circle and be another problem. The more your cam departs from the circle, the more violent those movements have to be of the tool oscillation as controlled by the overhead cam. So that, the more pronounced and sharp the cam movements are, in general, as a general proposition, the more difficulty you will have in making the roller follow the track of the overhead **(1403)** cam.

Q. How would that departure from the circle, as you put it, how would that influence or affect the work of the shaper? A. Oh, not at all. That doesn't have any effect on that at all.

Q. Let us assume, just for the instant, that if on the cam, the side of the cam,—and, by the side of the cam I mean the contour between the base circle and the exact nose of the cam—if we were to assume that was a substantially mathematical straight line instead of an arc, a curved surface, as they actually are, how would that affect the machining operation on the Walcott machines? A. Well, again, that speeds up; the rate of movement of the tool in its oscillation, about its pivot, and as I said, the faster you have this oscillating movement, the more difficulty there is in doing it at high production speed. Now, as far as the shaper is concerned, that doesn't make any difference at all. That doesn't speed up anything enough to be a factor.

Your Honor understands that the shaper completes the desired profile contour of the cam in one revolution and then it is desirable in the shaper to let the shaft go around again with a staggered cut to remove the ridges between cuts, so that the grinders will have less to do,

so that the cam shaft only makes two revolutions for a complete job on the shaper. So that, the form of that master cam could, if necessary, be very abrupt moving at that low speed. But, when you run this at 200 revolutions a minute, and rotate the cam, perhaps, 100 times or 150 times in cutting **(1404)** a cam, all those movements have to be done, not twice, but 150 times in a very short interval of time. That is what I meant by machines where you have a great many moving parts that you have to go at high speed, and at widely varying velocities. That is always a difficult mechanism, to make rigid and to make durable, to make a good producing machine.

We avoid that if we can, in producing fixtures on machine tools for large production.

* * * * *

(1406) Q. (By Mr. Farley): Mr. Brush, in your own experience in connection with production of automobile parts and automobiles, and, I understand that from your testimony before Judge Tuttle that sometimes not only from the early days of the industry, but right up to the present time, you have in recent years been consulted and have designed parts for the LaFrance Company, as well as other companies, isn't that true? A. Yes. And supervised it and consulted in the practices of **(1407)** production.

Q. Now, in that connection, in this long experience of yours, what has been your experience in connection with the practice, if there is such a practice, of re-designing parts of a motor or any part of a car to facilitate the machining or production of that part with machines which may or may not be available? A. Well, of course, for many years, and to the present day, to some extent, parts that are to be made are frequently designed where their efficiency will not be impaired to be adaptable in production to existing machines or fixtures.

That is to say, your Honor, there are two types of designer's choice. One is a design of work piece. If you don't sacrifice anything in it to fit a method of making, or a machine which embodies a method, or to determine the work piece, and adapt the method of operation to the work piece; sometimes one is practiced. Sometimes the other; and sometimes a little of both. It is just what seems expedient to the engineer who is—or engineers, who are responsible for the design and production.

Q. You heard Mr. Pioch's testimony concerning the modification of the bearings of the Model A car, did you not, Mr. Brush? A. Yes, sir.

Q. Now, what would you say as to whether or not that would in any way affect the operation of the Model A motor? A. To alter the design of the Model A cam shaft enough so that profiling of the cams could be done with the one-way cutting shaper.

Q. Yes. (1408) A. It wouldn't affect the motor at all, and it is the designer's choice.

Q. And, what would you say as to the possibility of machining that shaft on the old Model T cam shapers, assuming that they had been available as a physical entity in the Ford plant in 1927 when Ford made the change from Model T to Model A; would that affect the functioning or the output of the shaper? A. I think not, provided only this, your Honor—that the spacing of the cams (demonstrating) was near enough identical so as to be within the range of the adjustment of the shaper, and the spacing of the cams, I observe by comparing a Model A and Model T cam shaft are almost precisely identical.

Q. How about the width of the cams? A. Well, they are almost precisely identical. I would say that from inspection, from inspecting the Model T and the Model A cam shafts before me, that practically no change except in the holding features for holding the cam shafts would need to be done to the shapers.

Q. And, how about the master cams which control the contour? A. Well, of course, that goes without saying, I think that the—in fact, I think I said before that for any given cam, size and contour, the master cams must be varied.

Q. This, you heard the testimony concerning the attachment type of modification in which the two-way cutting is incorporated, such as illustrated by this exhibit, the wooden model, Exhibit 256? A. Will you read that?

Q. Yes. I am a little far away, I think. A. I would like to have everybody's indulgence. I am a little (1409) hard of hearing.

Put that on the record. Will you read the question back to me?

(The question was read by the reporter.)

A. Yes.

Mr. Farley: Would you read it again, please? You have the question, have you, Mr. Brush?

A. Yes, and I answered.

The Master: He said yes.

A. Yes, I heard it.

Q. (By Mr. Farley): Now, what have you to say as to the practicability or availability of that sort of a method? A. Certainly practical, and because it involves no departure in mechanical movements or principle of mechanics; certainly available.

Q. The Master asked a question of one of the witnesses as to the possible variation in, or increase in maintenance costs of the shapers employed—that is, suggested modifications over the maintenance cost over the Walcott machines. What would your opinion be concerning that?

Mr. Spohn: Mr. Farley, is your question limited to Exhibit 256?

Mr. Farley: To any of them.

Mr. Spohn: Oh, any of them?

Mr. Farley: Yes.

A. Well, it is my opinion that any of the variations in the embodiment of the shaper method of profiling cams which have been discussed here would lend themselves to more rigid, and therefore, **(1410)** more stable constructions than is possible on the Walcott type of machine.

Q. And, how, therefore, would that affect maintenance costs? A. I should expect maintenance costs of any well-designed embodiment of the shaper method to be substantially lower than the maintenance of any Walcott machine doing the same work.

The Master: As comparing with the original shapers with the Model T, these various shapers would be a less durable structure, would they not?

A. I think the attachment would. I don't think the double-cutting would. And, while there is an increase in the number of parts, the tension on each one is less, and they would be so light on that individual spacing mechanism that I think that that would stand up quite as well as

the mass movement, up and down, of each stroke of the entire slide of the master cam.

You see, in one of these you have a whole group moving up and down at a time. Now, I will say that that is only an opinion. There wouldn't be any considerable difference either way. But, with the light duty, or a little variation in length, it is my opinion that you couldn't see any difference in practice, although there might be a little.

Q. You were referring to the Exhibits 268 and 269 in your last answer? A. That is right.

The Master: I was wondering whether these exhibits, 268 and 269, can have, as you pointed out, with this different type of yoke in uniform velocity at both the return and original stroke.

(1411) A. That is right.

The Master: But, would that tend to slow up the shaper?

A. No. That would, if the shaper ran at the same speed, that is the same number of revolutions per cycle, it would step the speed of the tool-cutting up 33⅓ percent.

Now, if your Honor will recall that cutting speed was about 34 or 35 feet per minute, which for the tool steels available in, oh, 1920 to 1924, is rather ridiculously low.

The Master: They must have considered a desirable speed for the shaper then in use—

A. (Interrupting): Designed and put in use—

The Master: (Continuing): In 1915.

A. 1914.

Q. (By Mr. Farley): 1914 or 1915. A. 1914 or 1915, yes. Yes, I think that the shaper designed was very conservative. I am pretty sure that even as early as that cutting speed of the tool steels available, as I remember, I think, as early as 1914, they could have very readily have used around 50 feet a minute; and, I know that by 1924, for that kind of work, cutting speed of 70 feet per minute would have been perfectly permissible.

The Master: Well, assuming a given cutting speed as being a desirable speed for the Model T type of shaper would operate more rapidly than the modified shaper in Exhibits 268 and 269?

A. (Interposing): If it went—it had the same amount, yes, it would.

The Master: (Continuing): Could you get a more rapid speed on the tool without an undesirable wear or strain on the **(1412)** tool itself? Could you get an increased cutting speed, I should say, in a modified shaper, as in 268 and 269, because of the fact that you would be cutting four cams instead of eight; or would that have any effect?

A. That would have effect only on the parts of the Scotch yoke. And, of course, it is easy to make those things as substantial as you want them.

Now, the question your Honor asked, if the speed of the tool was the limiting factor, and that an equal velocity in each direction would lower the speed of the production, but the fact is that wasn't a limiting factor.

Q. (By Mr. Farley): What was the limiting factor? A. The limiting factor really on the shaper is the acceleration and deceleration speed of reciprocation of the table carrying the work piece. Now, that was quite as high on the return stroke as on the cutting stroke.

Q. That is, the mass to be moved precisely stopped at the end of the stroke? A. Yes.

Q. And reversed? A. That is right.

The Master: Where is the strain there? I don't quite understand.

A. Well, you have got the slide which carries the work piece moving back and forth.

The Master: Yes.

A. Your limit, in my judgment, would come on the ability to start and stop that quickly enough. Now, then, the straight sliding **(1413)** Scotch yoke with a sure sliding movement, would actually be kinder, would actually be a kinder movement than the swinging Scotch yoke. In the original design of that, what they did, they simply followed the old crank shaper practice to use the old quick return, and there is no reason why they shouldn't, because they were cutting in one direction only.

Q. And the type of Scotch yoke as shown in Exhibit 268, with equal speeds in both directions, would decrease

that speed as used in the original shaper, isn't that true? A. That is right. Even if running at the same number of revolutions per cycle, and at the same number of revolutions per minute.

Q. I think, just for the purpose of the record, so we might have that mathematically, I will show you Exhibit 264. Now, with the 220 strokes per minute, the 220 strokes per minute would remain effective, would it not? That is, with the strict Scotch yoke, not the sliding Scotch yoke? A. Certainly. That is what I said.

Q. Yes. A. If you ran your shaper the same speed, the same number of strokes per minute, and the same rate of speed around the cam shaft, the operating time would be identical, but the cutting speed of the tool will be raised precisely 33⅓ percent.

Q. That would mean, Mr. Brush, that in this last tabulation, surface feed of tools on Exhibit 264, 220 strokes per minute. Now, the next reading would be modified. Instead of cutting stroke, 220 degrees, return stroke 160 degrees, it would read cutting stroke, 180 degrees; return stroke, 180 degrees? A. That is right; and that would step the speed up one-third per **(1414)** minute precisely.

Q. And, that would, by exactly the same percentage, modify the limiting factor of the mass and the speed? A. Yes. Because your return stroke would have a 180 degrees in place of 120 to do it in; and the pure sliding curve is a kinder movement. That is, the acceleration and deceleration are lower rates than on the quick return, swinging Scotch yoke type of reciprocation.

Mr. Farley: Do you understand that, your Honor?

The Master: Yes, I do.

Q. (By Mr. Farley, continuing): Now, are you familiar with the Melling patent, Mr. Brush, which we have introduced in evidence here, as Exhibit 209?

The Master: Just a minute. While we are on the question of shapers. Are you familiar with shapers prior to, say, 1925, which did cut in both directions, or planers? That is a novel feature, or, at least, a feature that was never used on shapers previous to that time?

A. Well, now, as a production tool, no. As a tool-making proposition, yes.

Sometimes in the old days in tool-making jobs we would have situations where we would need—I will just make a hypothetical work piece—

The Master: (Interposing): Yes.

A. (Continuing): —would need to cut a surface between two shoulders that could not readily be milled or cut in the opposite direction, perhaps, because there might be a wall that would interfere with it. Now, the clever expedient by tool **(1415)** makers was, at least I thought so, was to bolt clapper box down to make the tool with a little tool holder, with two little screws—this is just diagrammatic (illustrating)—now each one of those tools is a little clapper box itself, and by making them uniformly, using them on a crank shaper, with a short stroke for a cut like that (indicating), where the swing of the Scotch yoke would make the cutting speed the same. That is the same height, and you run them back and forth. I never saw it on a production as a part of a machine, but that is one of the common expedients that tool makers used in making, doing jobs, that they can build any tool equipment that is precisely adapted for it, but that is not a characteristic that I ever saw embodied in a machine as such.

Mr. Farley: Would you mark the sketch an exhibit, please; the sketch just made by the witness; mark it Exhibit 276, please, Mr. Reporter.

(Exhibit No. 276 was then marked by the reporter.)

Mr. Farley: And I will introduce it in evidence.

The Master: I will admit it. What was 274?

* * * * *

(1416) Q. (By Mr. Farley): You are familiar with this Melling patent? A. Yes.

Q. You have read the patent and the claims, and understand them? A. Yes, I have.

Q. And, now, Mr. Brush, insofar as your testimony just before lunch was concerned, you pointed out to the Master how in the Walcott machine, the tool traversed a path, or through the curve of an arc, which was an exact replica of the curve or circumference of the rider roller, 26. And how, as the point of contact between the circumference of the roller 26, and the master cam 24, varied, that the position of the tool or the point of the tool 18,

with respect to the work-piece 25, was maintained exactly the same—will you state whether or not the claims of the Melling patent have anything to do with that particular method of operation? A. All of the claims defined that particular method of operation more or less elaborately, and in different language, but they are all directed to that peculiarity of the Melling machine.

Q. I wonder in that connection you would just consider claim 13 of the patent which is one of the ones that brings out, I think, that particular relationship fairly clearly and— A. (Interrupting): Claim 13?

Mr. Farley: Let's see. Have you got another copy. Just a minute. I would like to have the Master to have another copy so that he could follow.

(1417) A. Mr. Reporter, claim 13, Melling patent number 1,655,655—this claim is as follows—

Q. (Interposing): Go ahead. I am afraid I probably didn't bring an extra copy along. A. "In a structure of the class described, the combination of a reciprocating tool carriage"—that, your Honor, is the carriage, 11; "—a tool holder pivotally mounted on said tool carriage"—that is the tool holder, 15; "—a tool carried thereby"—that is the tool, 18; "—a master cam corresponding to the shape of the work to be cut"—that is the master cam, 24; "—an abutment roller coacting with said master cam for controlling said carriage"—that is the roll, 26, which, as your Honor observed through its coaction with the master cam now pushes the carriage, 11, back, and now permits it to advance towards the work-piece. Continuing: "The radius of said abutment roller" —that is the roller, 26; "—being the same as the radius of the arc described by the cutting edge of the tool,"—now, your Honor will observe that there is a celluloid transparent disc put on the pivot of the tool holder, 15, which just matches with the edge of the tool, and that disc is the same size as the rider, 26; "—and means for oscillating said tool holder,"—that is the cam, 21, acting on the arm, 19, of the tool holder, 15, by way of the roll, 20; "—so that the point of engagement of the cutting edge of the tool with the work corresponds to the point of contact of the abutment roller and master cam."

You see, that is nothing else but a defining of precisely this particular set of mechanical movements.

(1418) Q. Now, are you familiar with the machine of the Gordon patent? A. Yes.

Q. Will you state whether or not the operations or characteristics you have just described are different in the Walcott machine than in the machine of the Gordon patent? A. No, not at all.

Q. Why? A. In the first place, the movement of the cutting edge of the—

Q. (Interposing): Just a minute, Mr. Brush. A. Yes.

Q. My question was—probably you didn't get it—I have the habit of turning away from you when I am asking my question. A. Yes.

Q. My question was whether or not these operations you just described, the method of operation of this machine was different from this Gordon patent? A. I misunderstood you.

Q. Yes. A. It is just as different as—they are just as different as they can be and still have a change in the angular position of the tool. That is to say, the only thing common between the two which you can find, is the fact that in this particular embodiment as the tool moves up and down, it rocks about the center tool, 18, swings about the center of the pivot, and, consequently to the extent that it swings about it, there is a change in the angle of that tool with reference to a horizontal plane. That change is at a different rate, differently timed performance, a different function, so that only in that sense **(1419)** that there is a change in the angle of this tool, is there anything in common between the two sets of mechanical movements.

Q. Well, now, considering that claim again, briefly, Mr. Brush, will you state whether in the Gordon machine, the radius of abutment roller is the same as the radius of the arc described by the cutting edge of the tool? A. No. They have no relation to each other. In the first place, the cutting tool doesn't travel in an arc at all as the tool changes angle. The only arc which the Gordon tool can be said to travel in at all is a radius struck from this pivot, 24, down to the point of the tool. It moves to and

from the work in that very long arc, which is the single line of movement and oscillation of the tool, and is about the point of the tools at the center. And, so, the oscillation of the center doesn't give the point of the tool any movement at all. Whereas, in the Walcott machine, the oscillation of the tool about the center remote from the point of the tool upon which it is pivoted, gives the tool a second vertical movement, that is, an up-and-down movement, in addition to the movement toward and from the center of the work piece produced by the master cam.

Q. Now, you heard the testimony of Mr. Herklotz in the trial before Judge Tuttle? A. Yes.

Q. Did you not? A. Yes.

Q. And were you present during the testimony here before the Master when I went over with him briefly the experience the Ford Company had with the Gordon machine? **(1420)** A. I don't think I was.

Q. You weren't present here, but you were present in the trial before Judge Tuttle? A. That is right.

Q. Now, will you state whether or not, Mr. Brush, the difference in the functioning of the Melling machine, or the Walcott machine, as defined by the claims of the patent which you have just been discussing, would, in any measure, be responsible, or in any measure contribute towards the more, the greater efficiency of the Melling machine as a production machine as compared with the Gordon machine? A. Its movements as defined by the claims and as embodied in the Melling machine are wholly responsible for the greater efficiency of the Melling machine in the production of work-piece such as the Ford Model A cams.

Q. Now, how about the Fordson cams? A. And, in the similar case, Fordson cams.

Q. Now, would you please explain a little more fully to the Court why that is so? A. Yes.

Now, if your Honor will just watch the movement of the tool on the model of the Gordon machine, you will observe that the tool travels toward and from the work-piece in a substantially straight line. That is to say, an arc struck from up here (indicating); at the top of the machine, that it tilts about its point at a center; so as to tilt the tool about its point at the center, so that it com-

pletes a uniform cutting angle and the cam is supposed to do,—what I am making it do with **(1421)** my hand—hold that tool at the proper cutting angle; that is, pointing toward the center of the curve being cut, until it comes to the edge of that sharp toe, and in about six degrees of work, to swing up about 80 degrees of the arc, until it comes back to a proper cutting angle or work.

Now, there is no possibility of making a cam with an appreciable radius so that it will make that cutting angle remain correct. Within those limits of movement, you can't make an exterior of a cam with as much as an inch roller on it right on there, and control that tool swinging about its point so that it will correctly follow the shape of the work, and maintain an angle where the top surface of the tool points at the center of the arc being cut.

Now, then, contrast that where the tool is theoretically supposed to oscillate some 80 odd degrees about its point as a pivot, while the work piece rotates a matter of 6 or 8 degrees.

Now, take the Melling set-up on a cam with a sharp nose, and you will observe that the master cam, riding on the rider roller, starts to move the slide back, and, at the same time, the tool doesn't tilt about the point, but rises up to the nose of the cam.

Now, then, in place of having it tilt about its point while the work rotates through an arc of which the nose of the cam is a chord, the point of the tool now starts to move down, following the point of the cam, and, you see there is a rotation of some, oh, 50 or 60 degrees of the work piece while the tool moves very, very slowly around the point due to the **(1422)** second movement of the tool moving down as the point moves down. Then the tool rises up to the same position that the riding roller does on the master cam.

Now, as I said, while this tool does swing out of plane —two things, in fact, regarding this Melling—one is that the swing of that tool—its change in angle has no measurable value in the Melling device. That is an incidental, and, I might say, an accidental, fact, which is the result of the travel of the tool around an arc which corresponds to the rider arc.

Now, if that tool travelled in that same path, if a different mechanism were made so that tool travelling in

the same path, and didn't swing at all, just travelled straight up and down, there wouldn't be change enough in the presentation of the tool of the work to amount to anything.

That is to say, you saw the Westinghouse device work. Now, there was a change in the angle of presentation and it moved in the same way by moving bodily in place of swinging bodily. More than that, if this rider as it could be, were made a straight line, just a straight shoe rider in place of the roll, 26, if you just put a straight surface there vertically then the tool would do exactly the same job; not swing about a point then; because, then it mustn't—because, then it must travel in the same path corresponding exactly to the shape of the rider.

In that case, if you had a straight rider where that tool would be, just be slid up and down, and it would bear the same relation to form, it would rise up only in place of swinging up **(1423)** to simulate the shape of this rider; it would slide up following the contour of the straight rider; and, in that case, there couldn't be any so-called tilt. So the tilt that actually exists is too small to be of any measurable value, and it is there only because the simplest way to make the tool follow that curved contour which corresponds to the center of the roll. We have the roll here of infinite diameter. Then this pivot would be moving infinitely remote from the point of the tool, and it would just slide up and down. The mechanical motions would be of the same class or category. Do you see what I mean?

The Master: Don't you have this advantage of the Gordon machine over the Walcott machine: That with the Walcott machine, if the following roller fails to follow the master cam you get a different shaped cam, whereas, you don't with the Gordon?

A. Well, you have another situation—I want to, in answering that question, may I call your Honor's attention to the fact that any failure of any of these rollers to follow the cam, doesn't cut into, but leaves additional stock on the work piece. See what I mean?

The Master: Yes.

A. That is to say, it can only approach near the work piece as these two movements make it do, as I have showed you.

Q. Now, just a minute, on that point, you were saying any failure of these two rollers, you were referring to the rollers in the Walcott machine? A. Yes, sir, that is right.

(1424) The Master: If it failed to follow the roller, wouldn't that cut off additional stock here?

A. No, it would not. Let me answer this question first. May I?

The Master: Go ahead.

A. All right. This tool travels in this same circle as the riding roller, doesn't it?

The Master: Yes.

A. All right.

Mr. Farley: You are referring to Walcott, tool 18?

A. In the Walcott, yes. Now, this tool, 18, can never get outside of the tool of the master cam rider. This—that circle lying in that same contour can never lie beyond the tangent to the work piece. You see?

The Master: Yes.

A. No movement of this tool in any direction within that circle can ever approach the work piece closer than the point of tangency. Any departure from that point of tangency removes it away from the point of the work piece; you see?

The Master: I see the point.

Q. (By Mr. Farley): So that the record may be clear on that, Mr. Brush, I will remove the roller, 20, out of contact with the cam, 21, and I will first move the roller, 20, upwardly, into the path of movement of periphery of the cam. What happens when I do that? A. The point of the tools moves away from the work piece.

Q. Now, we will move the roller, 20, back in contact with the cam, 21, and the point of the tool is back in contact with the cams? A. Yes.

(1425) Q. Now, then, I will move the rollers, 20, downwardly, out of the path of the periphery of the cam, 21, and,

now, what happens? A. And again it moves away from the work, because the closest it can get to the work is the point of tangency; so, it never can get closer than the desired point of tangency.

In fact, the duty of the cam, 21, is to keep the point of the tool, 18, right at the point of tangency of this transparent hypothetical disc on the work piece, which is a representation or replica of the actual disc that rides on the master cam.

Q. Now, just a second on that. A. Yes.

Q. Just what does that mean, now, in terms of reproduction of the contour. That is, the fact that in the Walcott machine, the cutting point of the tool can never approach any closer than the point of tangency of the circle through which, or the circular path through which, the point of the tool is rotating with respect to the work? A. That means that it never can remove too much stock. If it fails to move so as to be, so as to remain at the point of tangency, in every case, it will leave additional stock on the work piece. That is inevitable.

Q. And that would mean it couldn't produce the gouges or the hollows in the work piece such as experienced by the Ford Company with the Gordon machine? A. It could not.

The Master: Could I see at this point that design drawn by Mr. Gordon, the Gordon Form cams? Do you have that here?

Mr. Farley: That is Exhibit MM, I believe (handing a **(1426)** document to the Master).

I might say, if the Court please, we have mounted on the model with which Mr. Brush was demonstrating, Defendant's Exhibit 57, the cam, the transparent plate cam, constructed strictly in accordance, and as accurately as it was possible for us to do it with this drawing which you now have in your hand.

The Master: Yes.

Mr. Michael: Yes, but you remember the witness pointed out why the cam on this model was perfectly incorrect.

The Master: Well, the witness pointed out that some of the other dimensions were out of tune.

Mr. Michael: Yes, the witness pointed out that some of the other dimensions were out of tune, yes, in dimensions with the Ford machine.

The Master: Yes, go ahead. Go ahead.

A. Now, if we turn our attention to the Gordon machine model, your Honor will observe that just the reverse of the situation is here, that the master cam which controls the contour of the work holds the tool into the work; that if the roll leaves the master cam, the point of the tool travels into the work piece.

The Master: You are speaking now of the master cam that—

A. (Interrupting): Controls the contour.

The Master: Yes.

A. Not that tilts the tool.

The Master: Yes.

A. This tilting of the tool is a device intended merely to keep (1427) the tool at a uniform presentation to the surface of the work.

The Master: Yes.

A. It has nothing to do with the path which the point of the tool traces.

The Master: Well, nobody ever claimed there was any difficulty in getting the roller, 46, to follow the master cam, controlling the shape of the cam being turned, did they?

A. Oh, yes.

The Master: I thought all the testimony related to was the difficulty of getting the rolls, 53, to follow the master cam, guiding the tilting of the tool.

A. There were both criticisms made. Only the criticism of the following of the master cam took the shape of the reports of the workmen, of gouges cut in the cam in the work piece.

Now, I was going to show you why that happened. You will recall the analysis that I made this morning of reactions between tool and work piece.

The Master: Yes.

A. The major force is tangent. The point of contact of the tool; that is, the cutting force; then, there is a little smaller force—the tendency of the tool to back away from the work, which I called the radial force, which has a resultant—that is upward—as the work piece, 18, is turning in this direction (indicating)—there is a resultant force upwards, outward.

Now, if we take these forces and analyze them, what we get is a force against the work piece at this point (indicating) in pretty nearly vertical—but thrown off the vertical **(1428)** a little bit—but the radial forces that keep the tool in a—

The Master (Interposing): We have that radial force increased here by mechanical advance of the spring, 49, don't we?

A. No, no. I am speaking of the reactions between the tool and the work piece.

The Master: Yes.

Q. (By Mr. Farley): That is the force there required to turn the metal, to tear the metal being removed from the work? A. Yes, that is right. And the tendency of the tool to back away from the work produces a tendency of pushing the work up and the tool down, and that is at a slight angle from the tangent; but, only a slight angle. But, you notice that on the base circle on the cam that thrust at a slight angle, pretty nearly passed through the center of the pivot up here (indicating) at the top where the tool swings to and from the work.

But, now, let us take and turn the cam around (demonstrating) until we get over here on the flank, on the flank of the cam—now, then, a tangent departing slightly from the true tangent, due to the radial force, passes away from this pivot, and misses it some 5 or 6 inches; you see? You see?

Now, as I said, the force is up on the work piece, and down on the tool, so that the force down on the tool which misses the center about 6 inches, in the extreme, or something of that order; and that force tends to do just that—to pull the riding roller away from the master cam that controls the work. That if that roller doesn't follow that means that just what was reported as happening, neces-

sarily has to; that the **(1429)** tools—that the tool goes in before, and might be in a little bit, because that force kept the roller from following the cam. Then it goes over the point, and now the force is reversed tending to push the tool violently away from the work.

That is the line of action. Now, away up on this side—and, I should expect that that sudden and violent reversal might even result in enough spring on that to show a perceptible hump on the other side. But, certainly, unless this spring is a very heavy one, unless the speed of the machine is slow enough, when you swing from the base circle, when you swing from the base circle at a couple of hundred revolutions per minute, come down to this (indicating), the flank of the cam, especially if the stock happens to be there on the work piece, it really amounts to a—well—something like that (demonstrating). That is what it amounts to.

Now, that action is entirely absent on the Walcott machine. Any failure of the Walcott machine to follow its cam movements will result in leaving additional stock, but under no circumstances will it cut into the work piece.

Now, you see, on this Walcott machine, your Honor, the angle, the extreme angle through which that tool—I will use the word "tilt"—extreme tilt—it is only about 20 degrees, it isn't enough to have any measurable value if the tool travelled in the same path. Without any tilt at all it would do just as much of a job. If it were straight, an up and down, then, there wouldn't be any difference, because it would be simply slid up and down in the guide.

So, I say, there is nothing in common between the two movements **(1430)** except the accidental tilt which has no measurable value in the operation, but the tilt is there, as long as a roller is used for a rider, and so long as the tool is used in the contour of the rider by the simple expedient, that of pivoting it, which corresponds to the pivot on the master cam rider.

Q. Now, Mr. Brush, Mr. Gordon was pointing out to the Master that the fact that it is a common characteristic of these machines that the tool in doing most of its work, is working on the side, and not the point, or front edge of the tool. What significance has that, if any, to the operation of the machines insofar as the tilt of the tools is concerned?

A. None at all. Still the point of the tool, if the machine produced the right work piece, the point of the tool must trace the desired contour or profile. And, I will say this—that if these machines were to be used to do a cam profiling job by means of a shaving tool that was fed in radially, a tool that was straightened, wide enough to wipe the whole piece at the tilt, which Gordon sought to get, and the tilt which Walcott does get, regardless of how sharp the nose of the cam is, which Gordon could get with a sufficiently round-nosed cam, then that tilt would be of extreme importance. But, when you are cutting with the feed across the work, you are doing the major amount of stock-removing by the side of the tool, and the point of the tool is doing nothing but taking off the final shaving that gives you the precise contour.

The duty on the point of the tool is very light, but it has got to be there, and it has got to travel in the right path. So, as you saw in the Westinghouse machine, the angle of presentation **(1431)** of the work in properly ground work would vary as much as this Model A cam requires, and still do a job.

The Master: Do you consider that there is any theoretical impossibility in the Gordon machine cutting a sharp-nosed cam?

A. Yes, sir. Let us assume that the cam has zero radius, and that you have 80-degree swing around from one side to the other. That 80-degree swing would have to be done in zero time, and that is a theoretical impossibility.

Now, then, as the radius decreases, approaches the edge, you approach that theoretical impossibility. Whereas, if you take the Walcott machine—now, let us assume that we have there an absolute knife-edge cam, then your contact on the master roll will roll up there until it is tangent with that knife-edge, and your tool rises until it is tangent therewith. Then, the tool has its zero radius, and you come around there (demonstrating); until you start in on the other flank of the cam right from that knife-edge; and the Walcott machine has just as much time to go around there as could be possibly required.

The limitation of the Walcott movement is this: If the flank of the cam were concave and of the same radius as the riding roller, that is to say, if this roller had a surface

contact, why, then, the tool would have to be oscillated throughout that arc instantaneously, and that would be impossible. But so long as the cam being cut there is convex the Walcott machine is competent to follow any convex form.

Q. All of the cams manufactured by the defendant, as far as you know, are they convex or concave on that side? **(1432)** A. They are all convex, and as far as I know, and I do know, I am familiar with the engine production of the Ford Motor Company since the company was producing it.

The Master: Have they ever used concave cams on automobile cam shafts, to your knowledge?

A. Yes. But only with some of the older engines with roller riders. These cams which the Ford Motor Company uses are all what we call mushroom riders. That is to say, a substantially plain surface rests on the cam. It isn't quite proper to say "rests on," because the valve seats with a few thousandths clearances, but when we come on the active part of the cam, then this flat mushroom surface which I might represent by a flat disc like that (indicating) just rides up over the cam, and down.

Now, then, these must not be concave, or even straight, because if you had a straight surface it would come up and slip, and, then, again, you would have the prohibitive thing; you have a noisy valve mechanism.

The Master: What are the factors in the function of an automobile motor which determines whether or not the cam is to be designed with a sharp nose, or a rounded, blunt nose?

A. You make the cam smaller in size, for a given lift, by having the nose sharp, and the factor which determines that is whether or not you get wear between the nose of the cam and the rider. And, we found that a 1/32 inch radius is plenty, because the duty is light while it is on the nose of the cam. You see, the valve has accelerated upwards, and deceleration has begun to take place, so that the movement of the cam tends to reduce pressure, and with the modern lubrication and materials, **(1433)** the 1/32 inch is plenty. And if you want to increase that radius, you just simply have to make that cam larger, and that would increase the size and the cost.

Q. (By Mr. Farley): In that respect, do you happen to know whether the Ford Company's cam design differed in any way materially than those of other engine designers? A. Oh, yes. There was a time, and I think there are some designers yet, who avoid a sharpened nose as the Ford Company used, although that is a perfectly practical and feasible cam and works very well in service.

The Master: Well, the only advantage to a sharp-nosed cam is that you don't have to have a larger base angle?

A. Well, you can see, your Honor, if it is a larger base circle, I immediately begin to increase the size of the bearing, necessary, if I am going to have this here (indicating), increase the size of everything, increase the clearance, and it so happens that in the engine tests we swing these cams pretty close, and every effort is made to keep these as small as possible in order to keep your engine compact.

Q. (By Mr. Farley): Now, there has been some discussion of the amount of rake and clearance on the tools, and I am quite sure it is a subject about which the Master would like to have a little more information, and that is whether or not there is any particular limitation of—as a practical shop proposition—between the amount of rake which can be given to tools and make them an effective tool, from positive to negative, and vice versa. A. Well, I would say this—and, again, I will say, as the **(1434)** Westinghouse fixtures demonstrated, there is no pre-determined and sharply recognized line—when the work piece comes in—you can't have the bottom of the tool come here (indicating), through here (indicating), like this—you have got to have clearance below.

Q. That, of course, goes to clearance? A. That, of course, goes to clearance, yes.

Q. Yes. A. And, as to rake—the greater is the angle at the point of the tool, the more metal you have got to support, and if you are having a shaving tool feeding in, and if you put negative rake in there, you increase the angle of the cutting edge, but you would have a radial thrust that would be prohibitive. That would actually tear the work, and with tools that cut by radial feed, you daren't go to any length at all. It is preferable to have a little top rake.

Q. With top rake you mean positive? A. Yes.

The Master: And soft steel is the metal also in which the cam shaft is made?

A. Yes. You see, these cam shafts were made out of case hardened steel; after this operation we are discussing is done, that cam shaft is heated up to red heat, in a carbonizing atmosphere, and carbon is the common hardening element that is alloyed with iron to make what we call steel, or hardening steel. The surface of that absorbs carbon, and that becomes a higher carbon steel on the outside, which, when heated, becomes hardened on the outside, and still remaining soft **(1435)** steel on the inside. And that is the thing—perhaps you have heard some discussion about it. You dare not leave too much stock on these cams for two reasons—one, there was more to be ground off in the finish grinds; and, two, if too much was taken off, it might get into the soft interior. That is all there is to it.

Q. (By Mr. Farley): Insofar as the operation of the Gordon machine and the Walcott machine at the Ford plant are concerned, Mr. Brush, what proportionate increase of efficiency do you think would be attributable to the Walcott machine because of these differences that you have just discussed such as outlined in the claims of the Melling patent? A. Just 100 per cent.

The Master: Well, what do you mean?

A. I mean, the difference.

The Master: You don't mean you can make any mathematical computation?

A. No. What I mean is—I spoke in the vernacular—these differences in the movements are the things that make all the difference in the behaviour of the two machines on the same work piece. And, if I understood Mr. Farley's question, he was referring particularly to these differences as defined in the claims of the Melling patent.

Q. (By Mr. Farley): Now, the plaintiff here, Mr. Brush, has submitted a certain statement of account in which rather important figures, let me say, are contained, and those important figures are derived on the assumption that if the Ford Motor Company had not used, or had not acquired the number of Walcott, **(1436)** or a number of

Walcott machines that were held to be an infringement, the Ford Company would have been compelled to grind all of the tractor cams and all of the cams of the Model A engines by the use of Landis grinders. What do you have to say about that? A. Well, it just isn't true.

Q. And what do you base that statement on, Mr. Brush? A. Well, I base that statement on the fact that the Westinghouse practice was in existence before that commercially. The Westinghouse method had been proved; and, as I recall the record, had produced commercially, a very substantial number of cam shafts. The shaper method, which has been known from before my time, had been embodied for making the Model T shafts, and either, by modification of the work piece to suit the one-way cutting shaper or by modification of the shaper to cut in two directions, and a number of embodiments of the shaper process could have been used to make either tractor or Model A cam shafts, or both. And, as far as that is concerned, the Pioch machine is an embodiment of a method of profiling cam forms, which I myself have been familiar with, and have used since before there were—well, I will say prior to 1902, in tool making—not in mass production, your Honor, but the actual process of making a convex cam profile by means of a cutting plane on an end mill. We did that in automobile production in a small way on the Olds engine that we built. I have made and seen made, many cams for machine tools where we used that same method of using an end mill—an end surface of an end mill to shape the profile of the cam.

(1437) Now, we did that on old universal tool-room milling machines. We did not practice that method as efficiently, because we weren't after mass production, and had no reason to, as the Pioch machine, then, it was the same method.

I mean the fact that any convex profile can be generated, in any convex profile that can exist, can be generated by a flat-cutting surface. Now, what we did in the tool room—

The Master: (Interposing): Well, let us take a recess here. It has been quite a strain on the reporter.

Mr. Farley: I just have another question, your Honor.

The Master: All right. Read the last there, Mr. Reporter.

(The last part of the answer was read by the reporter.)

A. (Continuing): That is right. What we did in making cams in tool rooms was to make the cam contour that we wanted, computing the distance that this (indicating) had to be from the cam center, and make as many cuts as we wanted, indexing the cams to the position computed; cutting the distance computed and making the cam with a series of flats, and, any convex surface can be generated that way.

Your Honor has doubtless heard that a circle is a polygon with an infinite number of sides. But, we didn't make an infinite number. Now, the Pioch machine made an infinite number. That is to say, the flat surface was actually going to and from the center of rotation of the cam at the rate which the cam was supposed to move the rider later. See what I mean?

The Master: Yes.

A. The cutter simply moved as the cam tappet in the engine moves, operates a little further from the cam center, in order to **(1438)** leave stock for grinding, which is simply moving up and down.

And the problem of the Ford Company for adopting this method; his cam production was a rather interesting thing. That had to do with the number of cams on the old-carriaged Olds, where I had just two cams, single cylinder engines, I had no problem at all, but I just simply made up a face cutter, very much larger than that, and this Pioch cutter and roll it around the cam and made my cam. But, the Ford Company on this Model A cam shaft had just this problem. In order to generate a cam with a cutting surface, the cutting surface must lie the full length of the cam to be generated.

Now, any end mill cannot have that, or movement at the center. Consequently, there has to be a center of some radius which cannot cut.

You have got a cutting ring in place of a complete cutting surface. The biggest cutter used had to be small enough to go between the enlarged bearing and the next cam.

Now, I have made up this little celluloid disc to simulate the surface of the cutter, so that you could see what that was.

Now, if you roll this cam around under this (indicating), you see that part of the cam lies in the non-cutting center, and couldn't generate. So the problem was this: Move this (indicating) off to one side until you get a chord of this cutting surface which lies outside the center hole and still stays inside the perimeter.

Now, if you roll your cam around until you get on this acting face of the cam, this cutting chord moves out this way (indicating).

(1439) If I kept it right where I had it, then, don't you see, I couldn't generate all of the length of this element. So, it was necessary to move this (indicating), out so as to keep the element of the cam being generated always in the inside of the perimeter and outside the center hole.

So, those cams, those Model A cams, to be cut on the Pioch machine with a cutter of this diameter, the cutter must move sidewise, back and forth, with the rotation of the cam so as to keep the tangent, the point of tangency being generated outside the hole, and inside the perimeter.

Now, that was what I called an impractical job. They just had to find out what the movements sidewise of that cutter were that they had to incorporate in the machine in order that they would have a cutting surface that always swept the full length of the cam at the line of tangent.

Q. (By Mr. Farley): I take it, then, to be your opinion, Mr. Brush, that you consider the method of milling the cams as later employed by the Ford Company on the Pioch machines was an available method to the defendant at the time it began its manufacture of Model A cams in 1929? A. Absolutely, yes; because there was no new knowledge that came to mechanics between '24 and '39, that would have aided a mechanic to work out this little problem of side shift of an end mill any better today than they could in 1924.

The Master: Let us take a short recess at this point.

Mr. Farley: All right.

(Short recess.)

Mr. Farley: Shall we proceed?

(1440) The Master: Yes.

Q. (By Mr. Farley): Now, you discussed a number of things that were available to the Ford Company in 1929, we will say, and, also in 1924. I don't recall whether or not you considered that resume of the matter of the re-design, or slight changing in the shafts such as testified to by Mr. Pioch. A. I think I spoke of the methods that were available, the shaper methods, the Westinghouse method, the milling method.

Now, the re-designing of the work piece is merely another way to make the shaper method available for that work piece, instead of the re-design of it which embodies the shaper methods.

The Master: Do you know whether it is true that practically all the large automobile manufacturers outside of Ford were using grinding methods to rough machine the cams prior to the manufacturing of the Walcott and Gordon machines?

A. No, I don't know. In fact I know of at least one company, which is a matter of record, the Knox Company, which was a small company, used the other milling method.

You recall I spoke of the milling methods—plural—now, the other method is actually an adaptation of the old Blanchard form lathe, in which the profiling is done not by the flat face of the cutter, but a round.

The Master: The same type of milling?

A. What?

The Master: The same type of milling, type of milling machine used by the Ford Company?

A. That was still a third method. That method by Ford, that early **(1441)** method was what we call a form mill in which the contour of half the cam was made right in the mill, and, just milling the half cam. This method, the Knox Company used, would be the same as the Walcott machine. If you took this cam, 21, off, and this tool holder, 15, and put a cutter on in place of this transparent disc, of the same diameter as rider 26, then you do the same thing.

The Master: Do you know whether any of the motor companies in a period since from '25 to '35 used the grinder to accomplish the same purpose as Walcott did?

A. Yes, they did.

The Master: Can you name some of them?

A. I don't recall what companies, but I know that there was considerable rough grinding done.

The Master: Well, would you be familiar, for example, with the method being used by the Dodge Company?

A. I am not sure.

The Master: With the Nash or Studebaker?

A. I think Studebaker were rough grinding; I am not sure of that.

The Master: Or the various units of General Motors?

A. The one that came to my mind was the Knox Company, and I am not sure about the others, because I never came in contact with this roughing cam, roughing problem, in my consulting work from 1910 or '12, until this cam came up.

Q. (By Mr. Farley): You heard the testimony of Mr. Pioch and Mr. Herklotz, Mr. Brush, to the effect that after the Ford Company had adopted the Pioch machines on the Model A production, and then changed to the V-8 production, that those particular **(1442)** Pioch machines could no longer be used on the V-8 shaft? A. That is right. And I wouldn't need to hear any testimony to know that was the fact, either. It is necessarily a fact.

Q. But, that when the Ford Company did adopt the V-8 production they still used the Pioch machines? A. Why, of course.

Q. Now, do you think that that change of the shaft which occurred between the A production and the V-8 production and the rebuilding of Pioch machines to accommodate them to those shafts would in any ways be different had the Ford Company been confronted, when they made the change from Model T to Model A, with the neces-

sity to do the same thing as far as the Model T cam shaft shapers were concerned? A. Well, I thought I had already said that when the T cam shaft was discontinued and A cam shaft came in, that the shaper method, had the Ford Company wanted to use it at that time, was perfectly available, either by adapting the work piece itself, the one-direction cut of the shaper or by re-designing the shapers for two-direction cutting to suit the work piece as it is here physically before us.

Q. Just one other question, and that is in connection with this matter of rake and clearance of tools. A. Yes.

Q. What is the situation in that respect concerning the proper amount of rake and clearance to be used by the machinist in any particular job that he may have in the lathe? How is that usually handled? Is it a matter of scientific design, or is it something which the man on the job takes care of? **(1443)** A. The man on the job takes care of that himself, just as the man who makes the milling cutter; he decides whether his work is of a nature, whether he wants rake on the top of the tooth and the amount of clearance that he wants on the face of the tooth.

When a machinist uses a single tool or lathe, or shaper, the competent machinist just goes and grinds the tool, in his own judgment, and then, too, a competent mechanic that is good enough—

* * * * *

The Master: You spoke also about the angle of the top edge of the tool, I believe, to the work piece, or to a tangent to the surface of the work piece—

* * * * *

The Master: In a side cutting tool. Is that of any importance?

A. You can go far enough so it is. There isn't anything that is any great nicety.

I think, then, as I said, that the operability of the Westinghouse set-up shows that that angle of presentation can **(1444)** vary as widely as this model A cam shaft requires, and still be a perfectly operative tool.

Mr. Farley: You may cross examine.

Cross Examination by Mr. Michael.

Q. Mr. Brush, you expounded at great length here on the differences here between the Gordon and Melling machines; all to the point that the Gordon machine had no utility and the Melling machine was a very good machine, is that right? A. I don't think I made either of those statements. I did say regarding Gordon machines in answer to the Master's question, that with the cam point of zero radius, the intended action of the Gordon machine became impossible.

Q. Do you know of any instance where a cam of an automobile cam shaft had a zero radius? A. No.

Q. Have you said anything before the Master in your testimony as to the differences in these two machines, the Gordon and the Melling, that you didn't say before Judge Tuttle? A. I think, perhaps, before Judge Tuttle—I am speaking from memory now—that I may have been remiss in not pointing out—if I didn't, and I don't remember that I did—that the so-called angle of tilt in the Gordon machine was so small as to be of no measurable value; that is, the angle of tilt, *per se*; that is, the error of presentation of the tool would have been, if there had been no tilt present at all, the variation in angle of presentation would have been of no consequence.

(1445) Mr. Farley: You mean the Gordon?

A. Although, I am not sure that I pointed that out to his Honor, Judge Tuttle.

Mr. Farley: You mean the Gordon machine or the Walcott machine?

A. In the Walcott machine.

Q. (By Mr. Michael): But that is the only thing you recall now as possibly not having been disclosed to Judge Tuttle? A. Why, yes, I think so. I wouldn't want to be absolutely sure. I haven't read the record all over. But, I had the same knowledge and the same subject matter before me, and did my best to explain it to Judge Tuttle as I have done my best to explain it to the Master.

Q. And, on your direct examination, you remember using the claim 13 of the Melling patent? A. Yes.

Q. And pointing out that the features recited there spelled the difference between these two machines and

made the one 100 percent better than the other? A. No, I didn't say anything like that.

Q. Well, speaking in the vernacular? A. Speaking in the vernacular, no. I said that all the difference there was between the two machines were due to the differences defined in those claims.

Q. Well, you are aware that both Judge Tuttle and the Court of Appeals held that those differences were equivalent? A. No, I am not aware of that. I am aware that the Court of Appeals said, if I recall the opinion correctly, that both had **(1446)** the tilting of the tool, and that there was that in common; and, that, Gordon, if I recall, the language right, was the pioneer in simultaneous tilting the tool in synchronization with the work piece, and I very carefully, in my testimony, as you recall, said that there was that thing in common, that there was a tilting of both tools in both machines.

Q. In that respect, they were both equivalent. A. In that respect, they had a common mechanical likeness. No, I wouldn't say equivalent, because the tilting is very —but, they have that thing in common, that there is a highly technical likeness, but, nevertheless, it exists. They both tilt the tool.

Now, the Gordon tilt is for one purpose; the tilt in the Melling is quite accidental, not for that purpose at all.

And, if the rider, as I pointed out to his Honor, if the rider is a straight rider, in place of a round one, carrying out the methods, the tilt would disappear.

Q. Well, let me put it this way: if the Court of Appeals did say that those two tilting movements were the equivalent movements in these two machines, you disagree with them? A. It would depend on how they defined it.

Q. Well, can't you just answer my question? A. No. Because equivalent, equivalency is too loose a term, not to be ambiguous. It is a fact that the intended tilt of the Gordon machine, which can be realized on a sufficiently round-nosed cam, and the accidental tilt on the Melling machine, both do maintain the same presentation angle of the two. In that sense they are equivalent.

(1447) Q. Now, you spoke of a number of machines here as being available to Ford in 1924? A. No, I think you are mis-quoting me. I said the number of methods

available within the skill of skilled tool and tool fixtures designers to embody.

Q. Well, what are we to understand? That Ford could have had a Pioch machine in 1924? A. In my judgment, yes. That there was no new knowledge that had come into the mechanical arts between 1924 and the day of the designing of the Pioch machine.

Q. And the knowledge that you speak of and from which you say that the Pioch machine was derived, you first knew of as early as 1902, I understood you to say? A. No, that isn't quite correct, either. I said the knowledge of the method. Now, the method is one thing; the method is one thing, and the embodiment is another. And, what I did say was that the methods were old. The problems of embodiment were just what I outlined to his Honor, and they involved nothing insofar as I could see, new or novel in the mechanical art.

It was just a matter of finding out how to move, how to best move a cutter of that size so as to keep the line of tangency outside of the center clearance hole and inside of the outer perimeter.

Q. Well, the milling method from which the Pioch machine was derived was known to you as early as when? A. Oh, 1902.

Q. Well, now, how long after that would it have been a designer's choice to embody that method in a machine such as the Pioch **(1448)** machine? A. I would say that that would not be so much a matter of whether it was a designer's choice, or not, but, as to whether or not, there was at any time a volume of work pieces, which management were willing to spend that much money on, for so highly specialized a machine.

Don't you see what I mean? These machines like the Pioch machines, like the shaper, practically without utility, except for that identical work piece of one, that is almost identical.

Now, to make it expedient to build machines as highly specialized as that, there must be assurance that there are going to be enough work pieces so that when the cost of machines is distributed over the entire volume of work pieces, it doesn't raise the cost of each work piece. With smaller production, an effort to specialize to that extent, would break an automobile company.

You must remember that the Ford Model T over a period of 16 or 17 years, 15,000,000 were built with not a major design changed. Now, then, that meant that a thing could be done in the way of a special machine for that model; that if the Packard, if they tried to duplicate for the higher priced model, would have just ruined the company.

Now, that is the situation in the industry which limits are to a large extent, the use of old methods of highly specialized machines and shafts.

Q. Well, how was automobile production sufficient to justify that such as the Pioch machine? A. Not until the introduction of the Model T Ford. There was never (1449) in this country large enough production to begin to justify it.

Q. That was? A. That was '06, '07, '08; I don't recall. That is a matter of record. I don't recall.

Q. Well, let us say 1910. Then, it is your testimony that the designer would have or could have availed himself of the Pioch machine in 1910? A. Now, let us put it this way: That had the Ford Company at the date when they originated the shaper, had they said, "Let us work on the milling method in place of the shaper,"—both are old methods—I think the Pioch machine would have been certainly originated, because it is just a choice of method; because such a shaper method is a little more elastic than the milling cutter method. I mean I can make a wider variety of cam profile with that.

Q. Do you know how many Ford made on the shaper? A. No, I don't.

Q. Would it also be true that the Pioch machine would have been available to any other automobile company in 1910? A. Why, I would say no. Because I don't know of anything, don't know of anybody who had volume enough to justify that much expense for one operation.

Q. Well, let us come up to 1920? A. Oh, the only production that I recall that was comparable to the T, wasn't until the Chevrolet got into active production. Chevrolet, sometime before the abandonment of the T, I think might have had production enough so that if they had asked their tool designers to see what they could do with the old milling (1450) method, I think they might

have gotten a Pioch machine, had the management chosen to ask that that method be investigated.

Q. I see. Now, how about the Oberhoffken design? Would that have been—I understood you to say that that was available to Ford in 1924? A. The Oberhoffken design of shaper?

Q. Yes. A. He designed the shaper originally. At least that is my—

Q. (Interposing): No. I mean this new design, 268 and 269. A. Oh. Well, I said in this sense, that if you have this work piece and a record of the one-way cutting shaper, to my mind it is perfectly obvious, that the way to handle that work piece by the shaper method is to cut in two directions.

Q. Well, is it your testimony that this design shaper, Exhibits 268 and 269, was available to Ford in 1924? A. Potentially, yes. Now, please don't ask a question that way. This is not a design of shaper. This is, as you recall my testimony, is a couple of illustrative sketches to illustrate Mr. Oberhoffken's concept, or an adaptation of the shaper to that work piece. Now, it isn't a design of a shaper. It is—those are just illustrative sketches.

Q. Well, I thought you said on your direct testimony that that is something that could have been available to Ford? A. Yes, quite.

Q. In 1924? A. Yes, I am perfectly sure that anybody that was capable of designing that shaper originally, might have done what is illustrated in those sketches, might have built the reverse-cutting of the (1451) two tools that interfered as shown by the attachment, might have modified the shaper.

I think I said it a half a dozen ways. I am not sure—I can't outline six, but I think I could—that there were a number of ways in which the one-way cutting shaper which was used on the Model T shaft as an embodiment of a shaper profile for mass production, there are a considerable number of ways in which that shaper method could have been embodied, and alternative machines would have handled the Model A work piece.

Q. And all those ways, regardless of number, would have been available to Ford in 1924? A. I think so.

Q. And how about 1920? A. I think so. Any time after the shaper had proven itself.

Q. I see. A. That the original shaper had proven itself a production machine; I should say that if you had a different work piece any competent tool designer could adapt the method with that experience available.

Q. Then if the shaper was a proven tool in 1915, these modifications in new machines that you have been talking about here, would all have been available any time after that to Ford? A. I think so.

Q. And any other automobile company? A. Well, I want to say "available"—I want to keep in mind—I don't want the inference in my answer to be that those things are available unless, or, until there is sufficient production to justify the cost.

(1452) In that sense a low-production plant does not have things available that a high production plant has. Don't you see? Don't you see what I mean?

Q. Well, it would be available to them if they wanted to use them, as I understand the testimony? A. Well, if they were prepared to put the cost into a special machine, yes.

Q. And, as applied to Ford, that would be the case, or was the case, according to your testimony? A. What?

Q. He had the production? A. Ford had.

Q. And the money, evidently, to reduce costs, so that all of these shapers, all of these shaper methods would have been available to him? A. Yes, the Ford had.

Q. After 1920? A. Yes, I think so.

Q. And, that would also apply to this attachment here? A. Yes, sir.

Q. Don't you think you could bring in at least 10 or a dozen men, different engineers, to sit down here and make different drawings? A. I said that I thought there would be no difficulty in finding a half dozen.

Q. Well, you said you alone? A. What?

Q. Well, you said you alone had thought of a half a dozen? **(1453)** A. No, I didn't. I said I was perfectly sure that there would be a half dozen modifications and practical.

Q. And, that would all have been available after 1915? A. Yes, I think so.

Q. Do you know the way Ford makes cam shafts now? A. Yes.

Q. Would that have been available to him in 1915? A. You are asking me for a knowledge of metallurgical progress that I am not sure about. It is a matter of getting castings of proper physical characteristics. Now, whether the casting art had progressed far enough—I think not—but, I wouldn't be sure about that.

Q. You haven't any knowledge as to that? A. What?

Q. You haven't any knowledge as to that? A. No.

Q. Well, Mr. Brush, it isn't your testimony here that these actual machines that you have been talking about, and that have just been drawn up or sketched up in the last hour here were available to Ford in 1924? A. Now, what?

Q. What you are saying is that Ford could have put some engineers and designers on those problems and developed something like this in 1924? A. Just as he did the original one-way cutting shaper.

Q. Yes? A. Quite so.

Q. And, after he got that, he would have gotten, too, any other **(1454)** shaper that any engineer, 20 years hence, might design? A. No, I don't think I said that. I think I said that in my judgment, that after the shaper had proven itself, it was then the skill of the then existing machine tool designer to embody that, and, if they wanted to use a one-way cutting shaper to modify the work piece so that it could be done with the one-way shaper. I didn't make any predictions as to what might appear 20 years hence, as I recall.

Q. Well, that is where we are, aren't we, 20 years hence from then? A. Oh, I thought you meant from today.

Q. No. If all the automobile companies outside of Ford were rough grinding cams up to the twenties, what conclusion would you come to from that, in view of your testimony here? A. Come to the conclusion that they were not availing themselves of the skill in the art that they might have used, as often happens, that an industry will do something because they can get a ready-made machine, and they will do something that is usually way below the efficiency that they could have if they would use a little more initiative. I have seen that happen so many times that that does happen.

Q. When was this Knox machine used that you spoke of? A. I don't recall the date of that. It is in the record of the case.

Q. Back around 1910, wasn't it? A. I think so.

Q. But not since then? A. No, that is the other method of milling, and does not lend itself; not because the method isn't good, but doesn't lend **(1455)** itself to the close-packed multiple location of the cam. That is another old method of profile. You can readily see the mark of defect itself, that if you try to lay axles parallel to cam shafts, drive the cutter, that you can't pack them in close together. The method is a good one.

Q. Did you ever see a shaper operate, Mr. Brush? A. Did I ever what?

Q. Did you ever see a shaper operate, Mr. Brush? A. Did I ever see a shaper operate?

Q. One of the old Ford shapers? A. No. Well, I may have. I don't recall. I have been in the Ford plant, and I may have seen them in operation. I wouldn't say that I had any definite recollection of it.

Q. Do you know of your own personal knowledge whether Ford ever straightened the cam shaft just before putting it in a milling machine? A. Well, if you are asking me if I know by observing—no.

Q. Well, let us get into this straightening a little bit. I didn't quite understand your testimony on direct. I would like to get that clear. First of all, I understood you to say that the Walcott steady rest was just one roller in contact with the work. A. No. Two.

Q. Can you make a sketch of the Walcott steady rest, as you understand it? A. Yes. Well, let us suppose we are considering a Model A shaft such as was turned out there, center bearing and cutting tool on the right-hand side, and a roll down underneath the work, **(1456)** and then a removable roll up above it. Call that center bearing.

Q. You are sure there weren't three rollers, two below and one on top? A. I think not. I don't know that I ever gave it particular study; no. No. My recollection is that there were only two on that particular machine.

Q. Well, if there were three would it hold the work better? A. Oh, yes. Yes, if you take three points, then you can hold the work in all directions.

Q. And would there be any occasion for straightening the shaft before you put it into the machine with a steady rest like that? A. Not within much wider limits

than the two-point steady rests, the two-point steady rests, that will refract all the work, but three-point steady rest will take the body out.

Q. So that there would be no occasion to straighten it if there were three rollers in the steady rest? A. No, if the three rollers were spaced so that you have a reasonable stand.

The Master: You mean that all of your testimony as to the necessity of straightening applies only to a steady rest with two rollers?

A. That is right.

The Master: And is not applicable where there are three rollers?

A. That is right.

The Master: It would be a simple matter to provide three rollers where a steady rest is a lathe, wouldn't it?

(1457) A. Yes, rather, provided the structure of the lathe is such as you are loading and unloading, and wouldn't give you any difficulty.

The Master: Well, isn't it quite common to have three rollers in a lathe?

A. Oh, yes.

Q. (By Mr. Michael): And that was common in, oh, as early as 1910, wasn't it? A. Yes.

Q. The answer was yes? A. Yes. With the straight work piece, though, the two-roller steady rest does quite a nice job. I mean, all you need is to keep your work piece so that it isn't bowed. Now, when I said straight, I want to be sure that you don't misunderstand me, that I mean, I am speaking of, about a general bow.

The Master: Yes.

A. And, if that is taken off of a work piece, your two-roller steady rest does a very nice job.

Q. (By Mr. Michael): Mr. Brush, this is, as I understand it, the Ford tractor shaft? A. That is right.

Q. Exhibit 35? A. Yes.

Q. Do you think it would have been available to Ford in 1919 or 1920, to make a revision in these bearings, the

same as you have proposed now in connection with the tool production? A. Do what?

Q. Change the length of the bearing? **(1458)** A. You mean reduce the length?

Q. And use the old shaper? A. Well, this bearing would have to be made removable. This is long enough to have been shortened. Shorten this one on this end (indicating).

The Master: Referring to the center bearing.

A. Yes, referring to the center bearing; get clearance to enter there and cut toward this (indicating), and make this (indicating) removable.

Q. Well, suppose we turn it around like this and shorten this end bearing (indicating)? A. Well, not so good. This end (indicating) has got the load. The proper one to shorten is the center. And, the proper one to make removable is the end one, here (indicating).

Q. Now, let us get away from the removable business. I am asking about shortening the center one and increasing the diameter of them, to make up for the reduction of length? A. Well, as far as center bearing is concerned, there wouldn't be any necessity for increasing the length of it, because that is a pretty stiff shaft, and, if you will recall, I told his Honor your cam tappets don't press on the base circle, and that means that the most load you could have from your tappets is the let-go of one of these, and the pick-up of the other, adjacent to it. That bearing, because of the design of the engine, has a more area than necessary.

The Master: That is the center bearing?

A. What?

The Master: That is the center bearing?

(1459) A. Yes, that is the center bearing.

Q. (By Mr. Michael): What about this end bearing? A. Well, this is a little bit different. You have got the time gears on there, and sometimes they put auxiliary drives on those gears. Still, I think, that is large enough so that it could have been shortened substantially. But the better way to follow would be to follow this center bearing on the Ford and make the rear one removable.

That would be the much simpler way to alter the work piece, to adapt it to the one-way shaping.

The Master: What about the effect of leaving the bearings the same length, and lengthening the shaft and using the increased length to make the recessed portion longer?

A. Oh, that means a little more change in the design of the motor, because this bearing is short. Usually because your motor crank-case design changes and is pretty close to that, and it would mean some more change of the design in the crank case, and so that is the reason I didn't suggest that, because that—I suggested those things which could be done wholly to the cam shaft.

The Master: Is there a removable bearing as durable and will stand up as well?

A. When I say removable bearing, I just mean a ring like this piece here (indicating). That would be just as good as that, and, of course, the Model T, if you want to use split bearing, this length here in between here (indicating), if you took that out and followed this practice it would be perfectly feasible.

Q. (By Mr. Michael): Well, to have a separate bearing, you would have to go through all the operations of making the bearings **(1460)** and— A. (Interrupting): Oh, no.

Q. (Continuing): —the additional operation of putting it on? A. No, you just simply grind the end of the shaft circular down there (indicating). It is below the base circle of the cam. Take this little button of steel, soft on the inside and hard on the outside, and when it is down, shove it over.

Q. Where did you get the little button? A. Drop it off.

Q. Yes, but you would have to make it? A. Yes, but we would have to make it.

Q. And you would have to put it on the extra operation? A. Yes.

Q. Now, here is Exhibit 238, and I think you testified you were going to reduce the center bearing and the end bearing? A. No. What I said, as far as I said anything about it, would be that this bearing is a long enough bearing.

Mr. Farley: That is the center bearing.

The Master: That is the center bearing.

A. That is the center bearing, yes. This wouldn't need any attention. Again, this would have to be a removable bushing.

The Master: Mr. Brush, are you referring to the bearing specifically by center bearing?

A. Yes; shorten the front end of the center bearing and make the rear end bearing removable.

Q. (By Mr. Michael): And, then, your testimony is that it would be dangerous to tamper with the length or size of the other end bearings? **(1461)** A. Oh, on the—I wouldn't say dangerous, but it might involve, depending on the design of the front end of the engine, it might involve more engine design changes. I am speaking of something that where it does not involve any material changes, where the changes are all on, or in the cam shaft.

Q. But, as an automobile engineer and consultant, therefore, you would say it would be feasible to shorten up the center bearing and make the short end bearing? A. Rear end bearing.

Q. Rear end bearing? A. Yes.

Q. And have this pressed here (indicating)? A. Yes.

Q. And, but it would be bad practice to tamper with the other? A. Well, I won't say one or the other, but there may be, there may be details in the engine design, or there may be a load for various reasons on the front bearing, that would make it indispensable, unless you were prepared to increase its diameter substantially.

The Master: Incidentally, when did Fordson tractor production start? Do we have that on the record?

Mr. Farley: I don't believe we have that on the record. I think it started, I think it was just around about 1917 or 1918, I think it was just at the end of the War. We can very readily get those figures, and it may be in the record down below. I will see if I can find it.

Mr. Michael: Well, in the record below, it goes back as far as 1919. It would be interesting to have the exact date.

(1462) The Master: We ought to have the date there, in view of this witness' testimony, at least.

Mr. Spohn: You mean production of cam shafts for those years?

Mr. Michael: For tractor.

The Master: You wouldn't have to get it as accurately as during the infringing period; but get the production of what they were for the first six or seven years.

Mr. Farley: It never exceeded 500 shafts a day during the first part, or up to the time they brought these machines up. That is my present information.

Mr. Michael: That is all of the examination I have.

RE-DIRECT EXAMINATION by Mr. Farley.

Q. Mr. Michael was questioning you concerning as to whether or not everything you had said here this morning, you hadn't said in the trial before Judge Tuttle.

The Master: That was everything, I think, with reference to the distinctions between the Walcott and the Gordon machines.

Mr. Farley: Distinction between the Walcott and the Gordon machines, yes.

Q. (By Mr. Farley): And, do you remember, Mr. Brush, that the Melling patent was not in evidence before Judge Tuttle? A. That is my recollection.

Q. And do you remember whether or not you were asked any question concerning claims in the Melling patent? A. Certainly not.

Mr. Michael: Oh, I don't think I had even intimated that **(1463)** he had said anything about that before Judge Tuttle.

Mr. Farley: I see.

Q. (By Mr. Farley): And, you did not, then, before Judge Tuttle, point out that the distinctions which you spoke of here today were the very distinctions outlined in the claims of the Melling patent? A. Of course. I couldn't.

Q. On the questions of Mr. Michael, concerning the change of the large bearings, which, I understand, are these, are the front or the rear bearings? A. Front. Those are the front, front end bearings.

Q. You are not as familiar with the mechanism in the Model A as Mr. Pioch? A. No.

Q. And you wouldn't in any way contradict Mr. Pioch's testimony about the feasibility of the shortening? A. No. I think I said that I would not care to make a statement as to whether or not the engine construction was such as to permit that. I wasn't sure. The center bearing could be shortened, and the rear end bearings could be made removable.

Q. Now, there is one other point in connection with the model, Fordson shaft, the F-446 shaft, Exhibit 35. Now, in comparing the Model T shaft with the Model A shaft, on your direct examination, you drew attention to the fact that the spacing of the cams in those two shafts, longitudinally, were substantially identical, and that the width of the cams was substantially identical? A. That is right.

(1464) Q. And you stated that with the slight change in the bearings, that because of that identical spacing, the Model T cam shaper could have been used without any redesigning of the shaper, except, substitution of the master cams, and the means for gripping the shaft? A. That is right.

Q. Now, what would be the situation with respect to the Fordson shaft, Mr. Brush? Could you take the very machine that had been designed and used by the Ford Company from 1914 up to the time of the acquisition of the Melling machines to shape the cams of the Fordson shaft? A. No.

Q. And what would it be necessary to do? A. Well, take that one thing—the cams on the Fordson are a matter of practically a quarter of an inch longer stroke. Now, that shaper was constructed with, as I said, with a regular crank shaper movement, with a swinging Scotch yoke, which was that whole reciprocating mechanism was designed around the proper stroke for that cam. You see, you can't lengthen that stroke 25 percent in a machine as highly specialized as that, without pretty much rebuilding the machine.

Q. Now, comparing the over-all length of the two shafts? A. As to whether the reciprocating carriage had span enough so that proper mounting of that larger shaft could be done, I think not. That, as I told your Honor, that shaper was a very highly specialized machine, built

around the doing of one operation on one work piece, and there was very, very little latitude.

Q. And if the Ford Company had wished to use a shaper on the tractor **(1465)** cam shaft, it would then have been necessary to rebuild and redesign the machine in the same way as they did with the Pioch machine, with that shaft from Model A to V-8 production? A. Certainly.

Q. Now, assume the Fordson production was only 500 shafts a day, would you think a production of that size would warrant the building of a special machine of that type? A. No. And, especially on the production of a tractor where your market is necessarily more limited.

The Master: Well, with what other methods are you comparing the shaper now? Do you mean it would be uneconomical to use the shaper as contrasted with the Walcott or Gordon machines, or as contrasted with the rough grinding or both?

A. Well, I think it would be uneconomical to use the shaper on that shaft, even as compared with the old form milling.

I wouldn't say without checking the figures—yes, I will, too. I don't think that the production that you had on the Fordson tractor would justify the Pioch machines or the shaper.

The Master: Roughly what size production do you think would be necessary to warrant the development or manufacture of a shaper machine, particularly designed for a tractor?

A. I think, perhaps, your Honor, what is more to the point than my own opinion is the fact that the Ford production has topped a million a year for a good many years, and has run right around there. I mean has topped a million a year for a number of years, and has run right around there for quite a number of years. And, when you get up to half a million or a million cars a year, the spread of the whole production is you can go far, and covering the development of 500 a day wouldn't be; if they **(1466)** were reasonably reassured over a number of years, then, I would say yes, it would. I don't think it would be justified until the tractor market had been proven, which the events proved it didn't prove. You see, the production of the trac-

tors was abandoned entirely, although it was a good little machine, there just wasn't the market.

Mr. Farley: Now, I might state, if the Court please, that I don't have any production figures for the tractor for these years prior to the acquisition of the Walcott machines, because, as far as our statements of account were concerned, those are the records in the accounting period that I asked Mr. Woehrle to get the exact figures. However, I will have those figures compiled and present them later. That is, the date of the beginning of the tractors, and whatever the tractor production might have been up until the date of the acquisition of the Walcott machines.

The Master: May I ask this?

Mr. Farley: Yes.

The Master: You said that the Walcott machine was more, was a more applicable type of machine than the Westinghouse or the shaper, for cutting cams on the cam shaft.

A. For variations of the work piece.

The Master: For variations of the work piece?

A. Yes.

The Master: So, would it be your conclusion, then, that the Walcott machines, or the purchase and use of the Walcott machines by the Ford Motor Company to rough shaping the tractor cam shaft, might be justified on a much smaller production than **(1467)** would the manufacture and use of a shaper or a machine of the Westinghouse type?

A. Yes.

The Master: Do you think, to go one step further, that the use of the Walcott machine and of the grinding machine for rough-shaping the cams would be approximately equivalent in that respect that where, for example, you got a production sufficient to use a grinding machine, you could also use, economically use, the Walcott machine?

A. I rather think so. I think the Walcott machine has some adherent due largely to that account, that the

design of the production can be widely changed, and still use the same machines, or substantially the same machines. It is adaptable for a considerable range of the work piece design.

Mr. Farley: I wonder if your Honor understands the particular properties of the Walcott machine in that respect, that is, which gives it a bit more adaptability?

The Master: Not 100 percent. I wish you would point that out.

Q. (By Mr. Farley): Well, I think you might do that, Mr. Brush.

The Master: Yes.

A. Well, let us take this model. Now, just say this is a unit here on the cam shaft, and I have got another unit like it, that I can set any distance I want between cams. These units are made thin enough so that I can set a unit for, let us say, this cam on the tractor cam shaft, and another unit for this one (indicating), and another unit for this one (indicating), and if I want to design a work piece for a new model of tractor **(1468)** engine, or where that is a quarter or three-eighths inch further apart, then, I will just set my unit further apart on the machine. The machine is built up of duplications of these units.

The Master: I was wondering why that wouldn't be true of the Westinghouse machine?

A. Well, if you are going to get the benefit out of that, you have got to build that machine pretty solid.

Q. (By Mr. Farley): Suppose you refer to that base-piece. A. The method here is a master cam on the back. This again, like the Walcott, in that respect, the cam holds the tool out of the work piece, and the spring sets it in. And, take these (indicating), move under the load of the cut, you have got to have a pretty good spring there, and you have got to have a pretty rigid mechanism. This would be more adaptable to variations than the shaper or the Melling machines. It would be intermediate, in my judgment, it would be intermediate between the two. I would say the most adaptable machines for cam shaft turning of usable machines is Melling; Westinghouse would come next, because, in my judgment, this will be somewhat less

adaptable than the Melling, if you get the rigidity built into it. And, still less adaptable would be the shaper and the milling machine.

Q. I don't know whether you brought out, Mr. Brush, I was interrupting there, for a minute, the fact that in the Melling machine these riders and cams, rather, cam 26 and 21, are mounted along a shaft, and can be spaced to a different spacing? A. Well, I took it for granted that that was understood.

Mr. Farley: You understand that particular proposition, your Honor, that having two shafts in the machine, one is for **(1469)** carrying all of the cams, 21 and another, for carrying all of the cams, 26, it is just a matter of sliding these particular things along as long as there is room enough in the cams to get them in?

A. That is right.

The Master: Yes.

A. Now, if your Honor is going to get the benefit of a machine that is rigid enough to push production, to crowd your feed, and to take a half cut, you begin to make this one piece, to make each one of these Westinghouse tools and master cams a unit, such as the Walcott is. Well, then, you destroy the ability to make this thing rigid if you make it all in one piece.

The Master: I was just noticing, I was just noting from an exhibit in evidence in this case, defendant's statement of account, Exhibit A, and Exhibit 4, attached thereto, motor production of Model T tractor as given the highest tractor production in the period through August, 1927, to—no, wait—this would be through—well, rather, through the entire accounting period, was about 11,000 in one month. That would be less than 500 a day. With that figure in mind as the maximum tractor production, would you think that at any time during the accounting period, it would have been feasible to, would have been feasible for the Ford Motor Company to have had shapers constructed to rough machine, or rough shape the cams in the cam shafts?

A. No. I think, your Honor, with that situation, the probability would be that if the Melling machine hadn't supposedly been available, my own judgment is that they would have gone back to **(1470)** the form milling that they used on the Model T before the shaper. It is a fairly efficient method.

The Master: Well, are you familiar with the fact that the Ford Motor Company was using the grinding method for rough shaping the cams on the tractors until the Gordon and Walcott machines came along.

A. I should expect that they would do that; those machines being available until they settled on some production method if tractor production justified it. I mean, the rough grinding machines, the rough grinding machine is a machine that could be gotten instantly on the market, and, while production is slow, and those grinds may be used for a wide variety of uses there.

They are not strictly limited to cam shaft grinders. The set-up on a rough grinder would be a natural one in initiating the production, and if the product promised to have a high volume for enough, have a high volume, then, I should say that any live organization would look for the more efficient method of producing that, because there were savings to be made. But, if I were initiating that—

The Master: (Interposing): Well, are these machines available on the market readily?

A. No. They would either build a milling machine or build a special fixture for some heavy standard milling machine. Those are questions of compromise, and, your Honor, to ask my opinion, I have given it freely.

The Master: Yes.

A. I don't pretend to say that management would agree precisely **(1471)** with me on my estimates, or that I would agree with myself, if I had all the figures of the problem available.

The Master: Well, from everything you know of the situation, would you summarize your conclusions broadly by stating that it is your opinion that the Walcott machine was relatively much more beneficial to the Ford Company in the production as used on the

tractor cam shafts than on the Model A and on the Model T cam shafts?

A. In view of the smaller production and the uncertainty of the market, in view of those two things, I should say, frankly, yes, your Honor.

* * * * *

RE-CROSS EXAMINATION by Mr. Michael.

Q. Do you know how many grinders it would take to turn out the production of one shaper? A. No, I have never checked that.

Q. Have you any idea? A. No. I will have to take the time check of the grinder. That would again, that would depend on some other factors, but, oh, I should say that a shaper ought to be, well, if you guess—let us say, three times as good a producer as a single-wheel grinder; maybe four times; I am not sure.

Q. Well, suppose the production of the tractor shafts was high enough to warrant, or how high a production would you say would—where would you draw the line with reference to the number of **(1472)** grinders? A. Well, I will make a guess, if you want to, but it is too hypothetical. There is always some grinding to be done about a shop.

Q. Well, when they put a grinder on a job like this, they are not available for anything else? A. That is it. Now, then, give a volume of production, and a belief in the continuity of production, you see, it is a matter of arithmetic because you have got to calculate the cost of the grinder, cost of the special machine designed, and I just don't know how to answer a question as hypothetical as that, without making an actual time study on a number of assumed factors—let's see—I think I can answer your question in substance. You have got to have enough spread of a special machine so that you can write it off against the product and still save money.

Q. Well, suppose one shaper would have turned out their entire production of Fordson tractor cam shafts and as against that, they had to buy three grinders; now, which would they be likely to do? A. Well, I think at that, if I were, I would be tempted to buy the grinders, unless I could assume that my production was going to mount and

be permanent. Now, if I was going into the tractor business, I don't think I would be enthusiastic enough about a sustained market of the tractors to build very many highly specialized machines. I have seen too many changes in tractor design. I have been in that business as a consultant to some extent, and I wouldn't, personally, be **(1473)** enthusiastic enough about the tractor market to go very far on expending money on highly specialized machines.

Q. You wouldn't compare the changes necessary in the shaper to turn the tractor shaft, with the designing of the Pioch machine, would you? A. I wouldn't what?

Q. Compare the two, or think they were comparable, the change in the shaper from the model to the tractor shaft, to a designing and a building of a Pioch machine, the first Pioch machine? A. Give me that, Mr. Reporter. Perhaps I am not hearing, but I don't get any sensible meaning out of the question. What was it?

(The question was then read by the reporter.)

Mr. Michael: Well, just cut it all out.

Mr. Farley: I didn't think your question was clear myself.

The Master: I didn't understand that either.

Q. (By Mr. Michael): I thought I understood you to say on your re-direct examination, that to change the shaper as they were used on the Model T's over to this Model F job, the F shaft job would be just the same kind of an undertaking and design as it was to build the first Pioch machine? A. No, I don't think I said that at all.

Q. Well, that is what I understood you to say. A. What I intended to say, and I think I did, that if you take the Model T shaft, and, then, take the Model A shaft, those shafts being of substantially identical length, substantially of an identical spacing, and substantially of identical cam face, that the design of the Model A shaft could readily have been altered enough so that it could be done in the actual Model T **(1474)** shaper.

Q. What would have been involved in changing the shaper to do that? A. In the change—what would be involved in the shaper?

Q. Yes? A. Itself?

Q. Yes. A. Well, you would have to have a new master cam for the cam form.

Q. Yes. A. You would have to have different holding chucks for the end.

Q. Yes. A. You would have to have a different center steady rest under the center bearing.

Q. Yes. And, you would have to re-space your tools, wouldn't you? A. No. Because the spacing and the length—

Q. (Interposing): Well, just— A. All right. I don't think there is difference enough there to.

Q. Well, there is a little difference? A. Well, there is a little difference.

Q. Quite a bit. When you get down here, they are off a quarter of an inch, anyway? A. I think not.

The Master: Isn't there some testimony in the record on that?

Mr. Michael: This isn't back here (indicating). There (indicating).

Mr. Farley: Well, suppose you split your differences there.

(1475) Q. (By Mr. Michael): Every cam is out of line a little bit, isn't that true? A. Yes, but those aren't out enough so that you could take care of that in making a special tool, making special tool bits. You might have to use special tool bits in the tool holder.

Q. Oh, you would have to re-space your tools? A. Or what?

Q. Or, you would have to re-space your tools? A. That would be one way of re-spacing your tools. It isn't sufficient. I am quite sure that you would have to change the tool slides. You would have, you could take care of that in the length there.

Q. What would you have to do to adapt the shaper to the F; that wouldn't be involved here, assuming that you put pressed bearings on the end, and all that sort of thing? A. Well, I spoke of that somewhat. Now, there is a cam, each cam is a quarter of an inch longer.

Q. Yes. A. That, in my judgment, would be outside of the range of the reciprocating mechanism of the shaper, and the shaft itself—

Q. (Interposing): Is longer? A. Is longer. Is enough longer so that I think that would be outside the best range of the modifying of the holding of the shaft.

Q. Well, you don't know that, do you? A. Well, I am expressing an opinion, and I am perfectly sure that there is no question that your spacing of your tool slide would be absolutely out of the question. In other words, for the **(1476)** tractor cam shaft it would have meant the construction of a complete new physical shaper to adapt the shaper method.

Q. It wouldn't mean the adding of any new parts, would it? It meant merely the re-spacing of what you had already had in that machine? A. Well, if I had a piece of cast iron a foot long, and I needed one 18 inches long, there is a complete new piece of casting.

Q. Well, it isn't a matter of serious design; nothing that would hold designers up? A. No, of course not. But I mean it would mean patterns and machining, by the making of a complete new machine, that, at substantially more cost, than, so long as your patterns were in existence, of repeating one of the old shapers. It means you have to have a complete set of drawings to build a machine, even though the method and its embodiment were identical.

Q. You don't think you could use any of the patterns for the old shapers? A. No.

Q. Even the bed plates and the base, and all that? A. No.

Q. Now, when Mr. Farley asked you about claim 13 and whether or not you had read that to Judge Tuttle, you mean that you didn't point out everything set forth in claim 13. As a matter of fact, you did, didn't you? A. Oh, quite. I couldn't tell Judge Tuttle, without knowing about Melling patent that there has been allowed to Melling, a patent which claims, which defined precisely the differences between the Melling and the Gordon machine, that were responsible for the difference in performance, in production between **(1477)** the Gordon and the Melling machines.

Mr. Michael: That is all.

The Master: Where these rough grinders for rough grinding the cams—if their use is discontinued for some reason, because of substitution of new machine, for example, or a type of machine, such as the Walcott machine, could that be easily adaptable to other uses around the plant?

A. Yes.

The Master: What are some of the other uses?

A. Well, take the making of machines, that is, such as the Pioch machines, you have got spindles and sleeves, that you want to finish circular things, that you want to grind circular, those grinders are readily adaptable back to a straight circular grinding work, and if they haven't been abused in their grinding they are just as good for any grinding.

The Master: If the company were going to buy a new grinder would they buy a substantially different sort of grinder than the rough grind used for grinding cams?

A. Well, they might, but, I mean if they had grinders that had been used for grinding, then, those grinders could have been adapted for other uses without throwing the machine away.

Mr. Michael: Well, only by adapting that without changing the cam or the other.

The Witness: Oh, certainly.

Mr. Michael: Certainly.

Mr. Farley: In view of the questions just asked Mr. Brush—if you would take the tractor cam shaft, Defendant's Exhibit 35, and just match it up against this wooden model, of the Model T cam shaper, as far as the size of the bed is concerned,—

(1478) The Master: (Interposing): Just come back here, Mr. Reporter.

The Witness: Well, that is just a convenient way of showing visually why I said in my judgment will be practically nothing of the original shaper for making Model T shafts, that could possibly be used in a shaper for a tractor shaft; certainly none of the patterns, and nothing more than possibly some screws and bolts, that might be used. As far as the special parts of the machine are concerned, that Model T shaper was too highly specialized to be modified or adapted to the tractor cam shaft.

* * * * *

(1491) ERVIN FRANKLIN was thereupon called as a witness on behalf of the Defendant, and being first duly sworn, *testified as follows:*

DIRECT EXAMINATION by Mr. Farley.

Q. Your full name, please? A. Ervin Franklin.

Q. Where do you live, Mr. Franklin? A. In Detroit.

Q. And you are employed by the Ford Motor Company? A. I am.

Q. And how long have you been employed by the Ford Motor Company? A. I would say since '25 steadily.

Q. And what is the nature of your duties at the Ford Company? A. Cost clerk in the cost department.

Q. You are in the same department as Mr. Hovis? A. Yes, sir.

Q. How long have you been doing that particular type of work? A. You mean cost work, Mr. Farley?

Q. Yes. A. Well, I started cost work about 20—about '28.

Q. What was the nature of your duties in 1927? A. Writing, writing operation sheets.

Q. Now, in writing up operation sheets in 1927, were you a time study man at that time? A. No, sir, I was not.

Q. You were doing that work in the Rouge plant? A. I was.

(1492) Q. Did you have a time study department at the Rouge plant at that time? A. We did not.

Q. Do you know when the company installed a time study department at the Rouge plant? A. I do not know exactly when it was, but, I believe it was probably five years ago.

Q. Was that— A. (Interrupting): Five or six; I don't know.

Q. Do you know who was—

Mr. Spohn: (Interposing): The witness answered "five years ago."

Mr. Farley: He said five or six years ago.

A. I wouldn't say. I don't know. I couldn't say exactly when it was.

Q. (By Mr. Farley): Do you know who was assigned to the job of starting the time study department at the Rouge plant? A. I believe Mike Klopsic was.

Q. And it was from whatever time Klopsic was assigned to that job that the time study at the Rouge was inaugurated? A. That is right.

Q. Now, Mr. Franklin, I show you a paper, couple of sheets entitled, "Cam shaft used in T-5949 assembly," and I call your attention to the initials, "E. F. B. G." at the bottom of the second page of that. What do those initials, "E. F." stand for? A. Those are my initials. The initials of my name.

Mr. Farley: I might state at this point that the sheet just shown to the witness is the original from which the photostatic **(1493)** copy attached to the Defendant's Exhibit—what is that?

(There was a discussion off the record.)

Mr. Farley: (Continuing): Exhibit 15 attached to Exhibit C, Defendant's statement of account.

Q. (By Mr. Farley): Are those your initials? A. They are.

Q. Did you prepare that particular sheet? A. I did.

Q. Now, I would like to ask first, Mr. Franklin, as to the times given for the various operations on that sheet. Were they made as the result of a stop watch time study? A. They were not.

Q. Well, just how was that sheet prepared, and for what purpose was it prepared? A. The sheet was prepared for inventory purposes to price our "in-process" inventory, and the figures were taken, were the word of the foreman or whoever happened to be assigned to that job of getting, or giving me this information.

It was an estimate of what they could do or the number of pieces per hour which was reduced to minutes.

Q. Well, now, for just what purpose did you employ this sheet, and, in that connection I show you another sheet which also contains the initials, "E. F.," on it, and which we find, upon checking, contains the same figures—let me first ask, have you checked these two sheets and are the various operations and times on the two sheets the same? A. I checked just the total, total minutes—2305.

Q. Now, will you just check those two sheets, the operations given **(1494)** and the minutes as detailed without reading them out. A. (The witness then checked the sheets.) The minutes are the same on both sheets.

Q. The figures are the same? A. Yes.

Q. The data on both sheets coincides all the way through? A. They do.

Mr. Farley: Now, then, I will ask that this second sheet be marked Exhibit 281.

(Exhibit No. 281 was then marked by the reporter.)

Mr. Michael: How can we identify that?

Mr. Farley: Exhibit 281 is identified as an operation sheet entitled, "Cam shaft, one used in T-5949 Assy."

Mr. Spohn: That is the same, however, that is on the other exhibit?

Mr. Farley: That is right.

Mr. Spohn: Are there any other distinguishing marks on it?

Mr. Farley: I will bring that out.

Mr. Spohn: All right.

Q. (By Mr. Farley): Now, I notice this difference between these two sheets, Mr. Franklin, that where Exhibit 281 has a number of pencilled notations along the left-hand side of it, there are no such pencilled notations on Exhibit 15? A. That is right.

Q. Now, will you explain these pencilled figures and state what the meaning of them is, and for what purpose those figures were put on there? **(1495)** A. The pencilled figures on the left of the printed column represent the minutes, or the total minutes down to that point. The figures on the right represent the total cost in money up to that point.

Q. Now, as I understand it, this sheet was the sheet that was used by you for the purpose of obtaining an inventory or taking an inventory of work in process of manufacture? A. That is right.

Q. At inventory time? A. Yes, sir, that is right.

Q. And starting with the column of pencilled figures just to the left of the typed figures, I noticed that you have the figure 1.20 as the first one, in the third vertical column from the right-hand side of the sheet. Just what do you get that figure 1.20 if you please? A. That is the total—this check out here represents the fact that some were found

in inventory up to that point, finished through that point, that total is a total of the minutes down to that point.

Q. In other words, the 1.20 is the sum of the .2400 and .9600? A. That is right.

Q. Adding those two together, you get 1.20, and the same is true for the second pencilled figure in the third column from the right of the sheet, which is 2.00. That figure is obtained by adding the typewritten .800 to the 1.20 pencilled figure? A. Right.

Q. And that is the system used all the way down, is that correct? A. Departmentally.

(1496) Q. And when we come to the point, to the next pencilled figure in the third column from the right of the sheet, 4.061, what is that? Is that the total of all of the figures, the typewritten figures immediately above? A. No, it is not. It is the total from the point where it goes into another department. Here is 410 department, or the machining department. That represents the total from the time it starts in 410 down to this point.

Q. Now, in order to be sure about that, will you just add those figures and see whether this 4.061 is the total of all of them, or just the total from .286 down to .534? A. (The witness does as requested by counsel.) That is correct. The total is for 410 department down to that point.

Q. Just for the 410 department? A. Yes.

Q. And it doesn't include the work in department 410? A. It does not.

Q. I see. And now, as I understood your testimony, the check mark in red crayon appears to me to be at the opposite, the number of the operation towards the left of the sheet indicates that you found stock finished up to those particular operations, from which it was necessary to estimate costs? A. That is right.

Q. Now, taking the figures on the pencilled figures at the extreme right of the sheet, will you just explain what they mean, please? A. Well, that is the cost in money, the actual cost in money of the part at those various points. For instance, the first one **(1497)** would be a cost of 12 cents or 12.01.

Q. That is on the number of pieces that were processed to the point of "Cut to length" in department 410? A. That is the cost for one piece.

Q. Yes, I see, that is the cost for one piece? A. Just up to that one point.

Q. And how do you get that particular figure? By multiplying the productive labor in the department at the hourly cost, multiplying that by the .2400, is that right? A. Well, the actual labor and the burden that was spent for making, that was spent for money, actually spent for making that part as reported by the time department, as posted on this sheet taken from the cost card, the actual cost card.

Q. Now, what particular cost card did you use to get those figures? That is cost summary card, Exhibit F-6? A. I did.

Q. I see.

Mr. Farley: Well, the witness has just referred to certain tabulations on the second sheet.

Q. (By Mr. Farley): And will you just explain those tabulations? You have here, "Mat.," that is material, 1027. And "L"— A. (Interrupting): That is labor.

Q. Now, let us just explain those figures. Show where you get them from your cost summary card? A. Well, the material is 1027.

Q. And that is shown on the cost summary card, Exhibit F-6 in the first block, on the left-hand side, which appears, over which appears the stamp, "Inventory, December 31, 1926," is that right? **(1498)** A. Correct.

Q. And, then, in the columns which begin, "Production," "Department," "Material," "Labor," "Burden," "Total," you take the figure of "Mat." on your sheet, the second sheet of Exhibit 281, and you get that figure of 1027 from the cost summary card, Exhibit F-6, is that correct? A. I do.

Q. All right. Now, just continue on that. A. 1027—0373.

Q. Now, your next figure—"L" is labor? A. Labor.

Q. And that comes from the column entitled, "Labor" in the same block, is that right? A. Correct.

Q. And the figure there is 0373? A. Yes. Next again is burden, 0371 or overhead as I have it. Overhead and burden being the same thing.

Q. You figure the amount of burden, 0371, as given on Exhibit F-6? A. Correct; making a total of the labor and

material, overhead, 2771 which also was taken from this card.

Q. Exhibit F-6? A. Yes.

Q. And, on your second sheet, you just used "T" to identify the total and the figure you have taken for the total is, coincides with the figure on Exhibit F-6. It was taken by you, as I understand your testimony, from this card, the cost summary card, Exhibit F-6, is that right? A. That is true.

(1499) Q. Now, the first series of figures about which you have been just testifying, they are all written in pencil and "410" appears in pencil above. Now, just to the right of those, there is another tabulation in which "Matl." "Labor," "O. H.," and the total is put on the card by means of a rubber stamp? A. Right.

Q. And immediately above that, you place, "410" in pencil? A. Yes.

Q. Now, just explain what relationship there is between the figures appearing opposite the stamped lines, where you get that information from the Exhibit F-6, if you did get it from that? A. There is a total labor in 410 department which is the machining department of .2802, and overhead of .4078, making a total of .6880 as expended in that department on that part.

Q. And those figures as placed on your Exhibit 281, all coincide with the figures on Exhibit F-6, and were obtained by you from that exhibit, is that correct? A. Correct.

Q. Yes. Now, will you just explain, Mr. Franklin, where and how you then figured the figures in the right-hand column and the significance of those? That is, the pencilled figures in the extreme right margin of the sheet? A. Taking the first figure, the total down to this point (indicating), the parts found would be—

Q. (Interposing): Now, down to what point? A. Finished through the first operation which is "Cut to length" here (indicating).

Q. That is the first point. This point.

(1500) Mr. Farley: Just leave this off the record.

(There was a discussion off the record.)

A. For the operation of, "Cut to length," there is a minute cost of .24, and that cost, the percentage of that to

the total of 2.40, whatever that percentage happens to be, is taken of this total labor and burden as represented here by the actual cost taken from the cost card.

Q. Now, just a minute. When you say, "As represented here," just explain what you are referring to? A. As represented by the .1744.

Q. On the second sheet? A. On the second sheet.

Q. Under the heading 410 and the pencilled figures or tabulation in the lower left-hand corner of the sheet, is that right? A. That is correct.

Q. (Continuing): Of Exhibit 281? A. Yes. And the percentage is taken of this .1744, which, in turn, is added to the material cost in that department, giving us a total of .1201 for the operation of "Cut to length."

Q. I see. Then, as I understand it, you find in Department 410 that the total minutes of the operations in that department or the total of 2.40 of a minute, 2.40 minutes, is that right? A. Correct.

Q. Then, you take the figure 220—.2400 is that right? A. Yes.

Q. And you find what percentage the .2400 is to 2.40, and take that proportion of the figure which you have over here, this .1744 on the second sheet, which is the total of labor and **(1501)** overhead, is that right? A. Yes. But I say that they have used a little shorter method to arrive at the same thing; but they have established a rate here, evidently by dividing this .2400 into the actual money, thereby getting a rate of 0727 which could be used by multiplying that rate by either one of these minute figures here.

Q. Yes. But, by any one of the minute figures, I see? A. By any one of the minute figures, yes.

Q. Now, your testimony just given, related to Department 410? A. Yes.

Q. And did you follow the same process with respect to Department 410 for the operations beginning with "Center both ends," operation No. 7 continuing on down to the end of the sheet, operation 50, "Handle and conveyor"? A. Same method used in figuring.

Q. Now, were those sheets used in the Ford department for any purpose other than the purpose of costing or determining cost of work in process for inventory purposes? A. There is one other reason, possibly, to acquaint the cost man with the sequence of the operation, that is all.

Q. Those sheets were prepared, as I understand it, by you, that particular sheet there? A. It was.

Q. Now, is that particular sheet and the information given in that sheet, would it be of any value for the purpose of determining the exact or actual production in pieces per hour or anything of that type for any of the operations listed there?

Mr. Spohn: Oh, if your Honor please, that is going pretty **(1502)** far with respect to this exhibit. It is calling for a pretty drastic conclusion.

Mr. Farley: There is the man that prepared it.

The Master: Well, he might know for what purpose it was prepared, but that is a pretty broad conclusion to ask whether it could be used for—

Q. (By Mr. Farley): Well, is that used at the Ford Company for the purpose of scheduling the operations or determining the actual time of any operation? Or, let me put it this way: Are you familiar with the operation time sheets that are prepared as a result of the time study by Klopsic, from Klopsic's department? A. I am.

Q. And is this sheet of the same character and does it have the same figures—are all the figures and times, minutes, on this sheet, 281 arrived at in the same way as the operation time sheet in Klopsic's department? A. It is not.

Q. Well, now, what is the purpose for which that sheet was used in the Ford Company? A. It was used just as a means of arriving at the cost of a part in process. In other words, this total, inasmuch as then we used it to arrive at the actual cost, it made no difference to us, whether or not this totalled down to an actual cost or not. It was a means of pro ration.

Q. I understand, that as far as the total minutes given, is that supposed to be an accurate figure, or is it an approximation? A. It is an approximation.

Mr. Spohn: Just a minute. Just a moment, your Honor **(1503)** please, the witness here, as I understand it, just prepared this summary from data that was given to him. That question calls for hearsay.

The Master: You already answered the question, did you not?

A. Yes.

The Master: You said it was an approximation?

A. Yes.

The Master: How do you know that?

A. I know that because I know that the man that gave me this information was telling me, to the best of his knowledge, approximately how many pieces per hour he could get. He might be within 50 percent, and, on occasions, I have found them not within 10 percent of the figure, and again, I have found them quite accurate.

Mr. Farley: The point there is, your Honor, here is the man that prepared that. He knew what purpose he was preparing it for, and certainly it is quite competent for him to say whether he was preparing that from the standpoint of having an exact figure along the whole line, and as a total, or was he doing it to get an approximation. There isn't anything hearsay about that.

The Master: I think I will let the testimony stand. There is an element of hearsay in almost all testimony, but this is competent.

Q. (By Mr. Farley): In order to make the record clear on that. Now, your duty was to prepare then, at this time, was to prepare a sheet of that character, is that correct? A. That is correct.

(1504) Q. And who instructed you to do that particular work? A. Well, I was instructed by Mr. Elmer, who then was at the head of our department, to get these things up in time for inventory.

Q. And were you given any particular instructions by Mr. Elmer as to how exact your figures were to be? A. We were not. We didn't—I was given to understand that I didn't have—they didn't have to be exact, as long as we got a method by which we could cost our inventory in process, inasmuch as we were absorbing all the money as represented by our actual cost figures; it didn't make any difference whether we were ten percent out or 20 percent or just where we stood on those figures.

Q. And that was the system you were employing at that time? A. It was.

Q. (Continuing): In the preparation of these sheets? A. Yes.

Q. Did you have available at that time, time study operation sheets that were made by the time study department? A. We did not, at the Rouge plant.

Q. Now, what is the system which you use at the present time, or do you know what the system is that is used at the present time for the purpose of establishing inventory costs at the time you take inventory, or work in process? A. Well, I know that we aren't using this method lately.

Q. Well, what is the method that you use now? A. I couldn't tell you just how they price them now.

Q. You are not on that particular work any more, is that the idea? A. No, sir, I am not.

Q. Could you state whether or not, at the time you prepared this **(1505)** sheet, you had available to you, time study operation sheets that were prepared by the time study department? A. We did not.

Q. And does that explain why you were put on the job of going out and making an operation sheet of this type? A. Yes, sir. We had to have something which this represents. It is an approximation as far as those minute costs are concerned on there. There has—it has something by which to price the inventory. That was the method at that time.

Q. When you said "this," you are referring to Exhibit 281? A. Right.

The Master: What date were you transferred from this particular branch of the department?

A. Well, I couldn't say the exact date, your Honor, but I—

The Master: (Interposing): Approximately?

A. But I think it has been about, probably, 7 or 8 years since I worked on there.

The Master: Before you discontinued or were transferred from that particular type of work, did the department at any time use the operation time sheets of the time study department for the purpose for which these sheets were used?

A. All the time that I worked on these sheets, we did not have a time study department at the Rouge plant.

Q. Now, referring to Exhibit 15, were you approached at any time by Mr. Woehrle in connection with this matter, and particularly with respect to the records that may be available—you know who Mr. Woehrle is? A. I do.

(1506) Q. And I am referring now to this particular sheet, Exhibit 15. Did Mr. Woehrle ask you when he first talked to you, or, at least, at any time that he talked to you, whether there were any operation sheets to be had anywheres in the records of the company? A. I told him that there were operation sheets, but where they were, I didn't know, exactly, where they were until we looked for them.

Q. And, as a matter of fact, you led Mr. Woehrle to the basement files in the Rouge plant and dug out a number of operation sheets? A. That is true.

Q. And, what, if anything, did you tell Mr. Woehrle about those sheets? A. I told Mr. Woehrle for what purpose we used them, as I have testified here.

Q. But, did you, at the time you gave him the—explained to him that these were not sheets that had been prepared as a result of information obtained from a time study, a clock-watch time study, or a stop-watch time study? A. I did. I told him that they were not time studies, but operation sheets as I knew them.

Q. Now, I show you two other sheets which are the originals of Exhibits 16 and 17, respectively.

Mr. Michael: Of Exhibit C?

Mr. Farley: Yes, of Exhibit C.

Q. (By Mr. Farley): And I will just mark in pencil on these, Exhibit 16 and Exhibit 17—taking Exhibit 16 and Exhibit 17, now, are they also sheets which you found in the basement files **(1507)** in the administration building of the Rouge plant at the same time that you found the original of Exhibit 15 and turned them over to Mr. Woehrle? A. They were found at the same time, Exhibits 16 and 17.

Q. Now, can you state whether or not the Exhibit 16 and Exhibit 17 are similar to Exhibit 15 with respect to the method by means of which the sheets were prepared and the purpose for which they were used? A. They were prepared and used for the same purpose.

Q. Prepared in the same way? A. Correct.

Q. And, calling your attention to the figures in pencil, first, on Exhibit 16, the two columns of pencilled figures to

the right, and the left, respectively, and the typewritten figures at the right-hand side of the sheet, are those figures compiled, and the same system followed there as followed with respect to Exhibit 15? A. They are.

Q. And the same is true with respect to Exhibit 17? A. Yes, sir.

Q. Now, then, as far as the figures for material, labor, overhead, under the stamped, or rather, opposite the stamps that are put on these figures; they, too, were obtained from cost summary cards similar to Exhibit F-6? A. They were.

Q. Do you understand the meaning of these figures—and, I will refer you to Exhibit 16 and Exhibit 281 in the lower right-hand corner of sheet 2, I find the word "Written, 12/21/25" and **(1508)** then, "Revised," "Revised," "Revised," "Revised," with different dates. Can you explain the meaning of that? A. The original sheet, the first sheet that was written, was written 12/21/25 on Exhibit 281, and the revisions represent a change made in the sheet; some change of some nature. What that change was, I could not say from the sheets.

Q. I see. Well, now, the fact that—let's see—let us refer to operation 17, "Turn cam lathe" .510. Does the fact that this particular sheet, Exhibit 281, which evidently was prepared on the 21st day of December, 1927—that is correct, isn't it? A. Yes.

Q. It was prepared? A. Yes.

Q. Now was the fact that that was prepared on that particular date and it contains the dates in 1926, two dates in 1926, and a date in 1925, does that indicate that this time .510 "Turn cam lathe" would have been the same on every one of the prior sheets?

Mr. Spohn: Well, if your Honor please, that is calling for a pretty far-fetched conclusion on that sheet.

Mr. Farley: The witness knows the system. He prepared the sheets.

The Master: I will overrule the objection.

A. I cannot testify from this sheet, whether or not that particular operation was changed. I don't know whether it was changed or not changed.

Q. These five dates in the lower right-hand corner of sheet 2, does it indicate that there were five sheets, four sheets, prior **(1509)** to this one? A. It does.

Q. Now, can you state whether or not the four sheets prior, as noted on Exhibit 281, were prepared in the same manner as Exhibit 281? A. They were prepared in the same manner because it was the only method by which we were—by which we prepared these sheets, these operation sheets.

Q. At that time? A. Correct.

Q. That is from December, the first dated being December 21, 1925 until December 21, 1927. That was the only method and means available to you at the Rouge plant for preparing sheets of that character, is that true? A. That is true.

Q. Well, now, insofar as my question on this operation 17, turn cam lathe, is concerned, you stated that you couldn't say just what was on the earlier sheets for that particular operation. Now, can you say whether or not the fact that you have that time of .510 for that operation on that sheet would indicate that that time had been the same on the other sheets? A. Well, as I said, a change could be made anywhere in the sheet, anywhere along the line, either in writing the operations time, or anything else. And I have no way of telling from this sheet whether or not any operation had been changed.

Q. No way of telling that none of the operations haven't been changed, is that correct? A. Correct.

(1510) Mr. Farley: That is all. You may cross examine.

Mr. Spohn: Now, if your Honor please, in view of this witness' testimony, I think the plaintiff should be advised by the defendant with respect to the reports heretofore filed.

Do I understand now that it is the position of the defendant that Exhibits 15, 16 and 17 are not time studies?

Mr. Farley: Exactly.

Mr. Spohn: Well, then, I don't understand this language on page 23 of Exhibit C, beginning about the middle of the page: A time study dated December 22, 1927—and I take it that is Exhibit 16—shows .80 minutes for the straightening operation—which is the figure that is in operation 18 on Exhibit 16—and 2.00 minutes for turning cams on Melling lathe—and that two minutes is in operation.

And we are to understand now that these are not time studies.

Mr. Farley, I would like to be, just be informed, if these are not time studies, particularly with respect to that one, and others.

Mr. Farley: Well, if your Honor please, I might state that this further statement of account was filed in response to the order, which was the second order which was issued by you at the request of the plaintiff, and dated October 29, 1937, and that order on page 7 says, or rather, in paragraph 7, says:

"Furnish operation sheets similar in form to Ex.—Exhibit No. 7 attached to Defendant's statement of account heretofore filed herein * * * (reading) * * *"

(1511) Now, after that was received, I called in Mr. Woehrle. Mr. Woehrle spent several weeks around the Ford plant endeavoring to find such records as may be available. He got these particular sheets through Mr. Franklin, and at the time when he first got these, we had not been informed—Mr. Woehrle had not been informed, or neither had I—in fact, it was only comparatively recently that we discovered the difference between these sheets and the regular operation sheets, regular time study sheets. However, as we had been called upon to furnish each and every sheet that we could find, we furnished them at the time, knowing, however, that the information on these sheets could not be accurate in view of our knowledge of the machines.

Mr. Woehrle, as I understand it, and I will have him explain that himself, did not employ these sheets for his computations. I understand he did not.

As to one of the sheets—(To Mr. Woehrle): You did use one of those, is that correct—on the Model F. I know they couldn't use the Model A on Model T, because we didn't think at the time that either of those, even if they had been time studies, they could be properly representative, because it was at the very beginning of Model A production, and at the end of the Model T production; we didn't think they could be properly representative, and I think, for that reason, Mr. Woehrle did not use them, is that correct, Mr. Woehrle?

Mr. Woehrle: Yes, sir.

Mr. Farley: And didn't base a computation on them. However as we had been ordered by the Court to produce operation **(1512)** sheets, we produced these, as they were then in compliance with that order to furnish every operation sheet that there was.

I will admit, quite frankly admit, that our furnishing of these sheets, naturally, could not be otherwise than a bit confusing to the plaintiff, because of the differences in times. That is, there is such a wide difference on this particular Exhibit 15 sheet, giving the time for the turning cam lathe operation of practically a half a minute, and you probably remember Mr. Moise's testimony concerning these operations.

The Master: Yes.

Mr. Farley: Our point is that, and throughout our statement of account, the figures and computation of Mr. Woehrle's were based on Model T production particularly, entirely upon or almost entirely upon—at least, as far as the output of the machines were concerned; the time study, Exhibit 14, made by Mr. Marentette, which Mr. Woehrle had thoroughly checked with Mr. Marentette concerning its accuracy.

Mr. Spohn: Do I understand, then, that when Exhibits 15, 16 and 17 were included in the account, it was your and Mr. Woehrle's thought to understand that they were time studies?

Mr. Farley: That was my idea about it.

Mr. Spohn: Well, the witness just testified that he told Mr. Woehrle they weren't time studies.

Mr. Farley: Well, the witness is mistaken about that.

Mr. Spohn: Well, your Honor, the plaintiff must state at this time that we have relied—put it this way—we have gone to a lot of time and expense in analyzing the account of the defendant here. We have hired accountants to do it. We have **(1513)** taken considerable testimony, and where, as the statement of account, page 23, says it is a time study and other operation sheets in there, there is no differentiation in the account that they are not time studies.

It seems that at this late date for the defendant to come in here and attempt in some way or other to deny

those sheets is going a long ways in this proceedings, and we must register a protest against that.

The Master: At what time did you discover the true status of these operation sheets?

Mr. Farley: About four weeks ago, your Honor please, and when we were prepared to establish the facts, in consulting the witnesses, I had Mr. Franklin come down to the office, found that he was the man that prepared this, and after carefully checking into the subject with him, and getting his version of how these things were prepared, then, that was the first knowledge that I had.

The Master: Do you recall your original conversation with Mr. Woehrle when you dug up these sheets for him?

A. Well, I found that in our conversation about these sheets, that they were constantly referring to time studies. I thought I tried to make that when I went down to Mr. Farley's office, I tried to convince them of the fact that these were not time studies in any sense of the word. They were merely operation sheets, as I knew them, for this inventory purpose.

The Master: When you talked to Mr. Farley and Mr. Woehrle in Mr. Farley's office were they seemingly convinced that these were time studies, the same as the others?

(1514) A. Yes, they were.

The Master: But, going back to the original conversation with Mr. Woehrle, about when did that take place?

A. About these particular sheets?

The Master: Yes.

Mr. Farley: When you first found them in the basement?

A. Well, my recollection of that would be probably four or five months ago. I don't know definitely.

The Master: Well, this statement of account which has been submitted in evidence here and which contains photostats of the sheets as Exhibits was submitted—

Mr. Farley: (Interposing): January 3, 1938.

The Master: January 3, 1938, over a year ago—and with that information in mind, does that refresh your recollection as to the time that Mr. Woehrle inquired about the sheets and you dug them up for him?

A. Yes; that, whenever it was, we dug them up immediately, found out what he wanted.

The Master: Well, now, just describe what Mr. Woehrle told you at that time?

A. He asked me if I had any papers, any operation sheets, and I believe, he said operation sheets, time study sheets; I told him that I had operation sheets around somewhere, and we looked them up and found these sheets.

Now, he might have said time study, and he might have referred to them as time studies. Today, they are unknown as time study sheets. At that period when these were written, we knew nothing of a time study department; knew nothing of a time study.

(1515) The Master: Did he ask you how you prepared these sheets, and how you prepared the times for them?

A. I don't believe so, at that time.

The Master: Did you tell him? Did you volunteer the information?

A. The first that I recall of telling him how these were made up was when I met Mr. Farley here in his office a few weeks ago.

The Master: Well, you told him originally for what purpose these were prepared, did you not?

A. I did.

The Master: You testified to that?

A. I did.

The Master: Did you tell him as to where you got the figures as to time from?

A. You see, your Honor, when you say the figures—

The Master: (Interposing): The figures showing the time for each operation?

A. If my memory serves me right, I told him how they were made up.

The Master: How many times did you see Mr. Woehrle at approximately a year ago, when he was first inquiring about this subject?

A. I don't believe I saw him, I don't believe I saw him again after the sheets were pulled from the file, until possibly a few months ago. I don't—I think I saw him once or twice in that period of time from the time we first talked together.

The Master: How long a conversation did you originally have?

A. Very short and brief, I would say. Probably a couple of minutes.

(1516) The Master: And, then, did you immediately go down in the basement and find these sheets, or what happened?

A. I told Mr. Woehrle that I thought they might be found, and he went down and found them.

The Master: And did he come back and ask you about them afterwards?

A. Not to my knowledge he didn't. That is, not right away. Possibly he might have questioned me about them, maybe three, four, five months later. As to time, I couldn't say.

The Master: All right.

Mr. Spohn: There is nothing before your Honor. There is nothing I requested. I just made the observation.

The Master: Well, I wanted to get as clearly as possible the facts from this witness.

Do you have any questions?

Mr. Spohn: Yes, I have some cross examination.

The Master: Yes. I have just the one question here.

If these figures were only to be approximations, why did you carry them out to the third decimal place?

A. We carried out at that time all of our figures, all our figures in cost work carried out to four decimal places

in money, and the minutes, and the minutes were often carried out to four decimal places; and, I believe, here, about, possibly four years ago, we started to carry the minutes to two, and we still carry the money to four.

The Master: Did you decide on the number of decimal places to carry it out, or was that just the practice?

A. No. That was the practice at the time.

(1517) The Master: All right.

We will take a brief recess.

(Whereupon a short recess was taken.)

The Master: All right, you may proceed.

Cross Examination by Mr. Spohn.

Q. Now, Mr. Franklin, both exhibits, the one marked Exhibit 15 as attached to defendant's statement of account, and the other, marked Exhibit 281, have down on the right-hand corner of them dates on which these exhibits were written and revised, revised and re-written or revised, isn't that true? A. Right.

Q. Do you know how often the defendant took an inventory? A. Used to take it once a year.

Q. And that would be when? While you were making up the sheets? A. I believe it was between Christmas and New Year's, if I remember correctly.

Q. And did—do you know whether the defendant closed its books on a calendar basis at that time? A. I couldn't tell you.

Q. But the inventory was taken between Christmas and New Year's during the period you were writing up Exhibit 15 and Exhibit 281? A. I believe so.

Q. Yes. And that was the only time the sheets were prepared? A. No. I covered the plant and it took me a year to cover the plant, and if a short time before the inventory, we were then lacking a lot of sheets, or we felt that they needed a revision brought **(1518)** up to date, we would do so. But it was usually the sheets that we were lacking and in going through a department where we lacked a number of sheets for the pricing of inventory, we would go through and make a hurried check of what was already in there.

I wrote them on here. It took me approximately a year to get around, and then, if I didn't quite make it around, we would hustle out and get the foreman to write them, and everything else, and everything else.

Q. And they were prepared for, you say, defendant's inventory? A. For inventory and to acquainting the cost men with information.

Q. And do you know of what use these were after you prepared the figures? A. Then figured the inventory on them. The figures, the figures to the right there were put on by the comptometer division.

Q. Yes. A. (Continuing): After I had put the cost figures on here at the bottom.

Q. And you pencilled the figures on the right there? A. Yes.

Q. And do you know whether that is the inventory the defendant regularly used thereafter? A. I couldn't say that. I would say that this figure was used at that period.

Q. For inventory purposes? A. For inventory purposes.

Q. Yes. Income tax returns made on that inventory basis? A. I wouldn't know that.

(1519) Q. You wouldn't know that? A. No.

Q. I see. Now, what is on the top of Exhibit 281, and, again, on the top of Exhibit 15, what do the words in parentheses "One used in T-5949 Asy period" mean? A. That was used in that particular assembly.

Q. Well, what is an assembly? A. An assembly of a cam shaft, and, I believe, in this case it consisted of a gear and a cam shaft.

Q. And why would those figures be used in an assembly? A. The figures used?

Q. Yes. Why would you gather those figures together for an assembly? A. Well, in building up an assembly, the cost, actual cost, practice when come time to figure this particular part, T-5949 assembly, you build it up from either a check in the shop—usually a check was made in the shop for that assembly. To my knowledge, there is no reason for it. There is no apparent reason for it.

Q. Well, do you know whether this particular Exhibit 15, and also Exhibit 281, whether those costs, figures therein were used in assembly costs, T-5949? A. You mean these figures here?

Q. Yes. A. I know they were not.

Q. You know they were not? A. Yes, sir.

Q. Well, don't you know it is a fact that the defendant used to **(1520)** charge out its cost of goods sold on the basis of figures such as set forth in Exhibits 15 and 281? A. I don't know that.

Q. Did you have any experience with respect to that? A. May I have that question again, please?

Mr. Spohn: Read the question.

(The question was then read by the reporter.)

A. I don't know that. I know that any of these figures appearing on here were never used for cost of any kind.

Q. When you say, "appearing on here," you are now referring to Exhibit 15, is that right? A. Exhibits 15 and 281.

Q. Yes. On Exhibits 15 and 281, over to the right, and down the corner, revised March 22, 1926; does that particular date have any significance to you? A. No, it does not, other than the fact that it was written and revised at that time.

Q. I see. May they have been prepared for an income tax return? A. Not to my knowledge. I don't see how it could.

Q. You were just told to prepare it? A. That is right.

Q. Don't know what purpose it was to be used for? A. That is right.

Q. I see.

Mr. Spohn: If your Honor please, there was considerable testimony taken, if your Honor will remember, on cross examination—I think it was last February or March, on some of these records, and plaintiff would like the opportunity of recalling **(1521)** this witness for further cross examination after we check back on that testimony.

The Master: Is that agreeable to you?

Mr. Farley: Yes; all right.

There is just one other question I would like to ask Mr. Franklin.

The Master: Yes.

RE-DIRECT EXAMINATION by Mr. Farley.

Q. At the time you gave these sheets to Mr. Woehrle, did you know, or did he tell you the purpose for which he wanted them? A. He did not.

Q. And you did not know at that time what purpose he did want to get the sheets for? A. No, I did not.

Mr. Farley: That is all.

RE-CROSS EXAMINATION by Mr. Spohn.

Q. Mr. Franklin, did you know Mr. Woehrle prior to that time? A. Prior to which time?

Q. Prior to the time that he came to you with respect to those sheets? A. Never.

Q. He didn't then state for what purpose he wanted those sheets? A. No, sir, he did not.

Q. And you just handed him the defendant's records here without knowing the purpose for which they were to be used? **(1522)** A. Yes, sir. I was told by my superior that I was to give him anything that he wanted.

The Master: And what did he say he wanted?

A. And he told me he wanted sheets, operation sheets, and, I believe he said time study, but I knew what he was after, regardless of what he called them. There was only one thing I could give him, which we have done here. He might have called them time studies; he might have called them operation sheets. I wouldn't say to that. But, I knew, whichever term he used, I knew what he wanted.

The Master: And when you gave him these sheets, did he inquire about their nature, or how the operation time was computed?

A. Not to my knowledge. Now, later, he may have. I don't believe that he did, now. Not to my recollection.

Mr. Spohn: That is all for now.

Mr. Farley: Might I ask this question?

RE-DIRECT EXAMINATION by Mr. Farley.

Q. Do you refer to these sheets in your department as operation sheets or time studies, either one; I mean, do you use either term? A. I have always used the term of operation sheets.

Mr. Farley: I see. That is all.

RE-CROSS EXAMINATION by Mr. Spohn.

Q. Well, they are called time studies, too, aren't they?
(1523) A. Some might call them that.

Q. You yourself do, too, don't you? A. I have never called the sheet a time study sheet at any time until its recent discussion here. I have always referred to them as operation sheets. But, there are operation sheets today, but they use different time study that are time studies.

Mr. Spohn: I would like to have further cross examination later, your Honor.

The Master: All right.

Mr. Farley: That is all.

The Master: You are excused, then.

(The witness was thereupon excused.)

* * * * *

(1595) JOSEPH HENRY ACHTEN was thereupon called as a witness on behalf of the Defendant, and having been first duly sworn, testified as follows:

DIRECT EXAMINATION by Mr. Farley.

Q. Please state your name. A. Joseph Henry Achten.

Q. Where do you live, Mr. Achten? A. Oxford, Michigan.

Q. Were you ever employed by the Ford Motor Company? A. Yes, sir; from 1915 to 1933.

Q. What was the nature of your duties at the Ford Motor Company? A. Various positions, as foreman, general foreman, maintenance, and, since 1927, production department superintendent.

Q. In 1927, when you were in the production department, what particular department of the Ford Company were you in? A. Department 410.

Q. What particular part does that have to do with the manufacturing there? A. Camshaft, A-6250, and T-410; A-6135. There are 13 different parts.

Q. Just when was it in 1927 that you went in the cam shaft department? A. June 7.

Q. What type of shaft were they manufacturing in the department at that time? A. Model T.

Q. Do you recall when they changed over to model A production? A. That very same time.

Q. That very same time? A. Yes, sir.

(1596) Q. That is, they were changing their model A production at that time? A. Yes, sir.

Q. What was the nature of your duties in the cam shaft department at that time? A. General foreman.

Q. General foreman of the department? A. That is right.

Q. Do you know anything about the tolerances, if any, that were adopted by the Ford Company with respect to the standards of precision and accuracy of the model A shaft as compared with the model T shaft? A. Yes, there was a distinct difference. The model A cam shaft was held within closer limits than the model T.

Q. Closer manufacturing tolerances? A. That is right.

Q. Can you state, from your own recollection, how much closer the tolerances were on the model A as compared with the model T? A. Well, in regard to the cam, the bearings followed a lower figure. The tolerances on the bearings were practically the same. But the cams are entirely different tolerances. The model T, I think, ran as high as .008, where with the model A we only had .002.

Q. That is, the limit between upper and lower tolerance? A. That is right.

Q. You had a .002 allowance to work with on cams for the model A, whereas, on cams of the model T you had .008 allowance, from upper to lower limits? A. Yes.

(1597) The Master: That was on the finished job?

A. The finished job, yes.

Q. (By Mr. Farley): How long did you remain in the cam shaft department, Mr. Achten? A. Until December of 1929.

Q. You mean December of 1929? A. Yes, sir; that is right.

Q. What was the nature of your employment after December, 1929? A. I went to Germany for about three months, and I came back and worked in the motor experimental.

Q. What was your trip to Germany, a private, personal matter? A. Yes, that was a personal affair, yes.

Q. How long did you work in the motor experimental? A. Until 1932, March 20, 1932.

Q. And then what? A. And then I was sent to Russia for one year, and I came back in April, 1933, for the Ford Motor Company.

Q. Your trip to Russia was a trip on behalf of the company? A. That is right.

Q. What was the purpose of your trip to Russia? A. To set up and supervise production of the model A motor.

Q. Where? A. In Nizinovogarod, is the name of the city; I don't know how you spell it, but they call it Gorky today; it is 300 miles east of Moscow.

Q. Was your work there in that plant owned and operated by the Ford Company? A. No, it was not. The plant was owned and operated by the Russian government; but I understood from the sales manager **(1598)** that the Ford Motor Company had agreed to send a group of engineers over there, in case they found it necessary.

Q. This plant, in what is now called Gorky, that was operated by the Russian government? A. Yes.

Q. The Soviet Republic? A. Yes.

Q. Ford, the Ford Company, had no ownership or interest in that plant? A. No, sir.

Q. At the time you went into the cam shaft department, what type of machinery was in the department at that time, for the purpose of machining the cams and cam shafts? A. I recall two different types. They had the cam shaper, and the Melling lathe.

Q. Were the cam shapers in the department in 1927, when you went in there? A. They were.

Q. They were shapers? A. They were—only two of them.

Q. Did you actually operate those two shapers in the department? A. Yes, on the model T cam shaft.

Q. What did you use on the model A cam shaft, for machining the cams, when you started model A production? A. The Melling cam lathe.

Q. Can you state whether or not you experienced any difficulties when you switched over to the model A production, in producing shafts for the model A on the Melling cam lathes? A. Well, our difficulties were many. In the first place, we **(1599)** could not hold a form of the cam

accurate enough to grind these cams with the tolerances on the print.

Q. What were the tolerances on the print, if you recall? A. I believe the tolerances on the grinding operation were .002.

Q. How much did you allow, or would the print show that the amount to be left on the cams for the finished grinding operation? How would you grind to the size to which you rough-turned, or were supposed to rough-turn? A. No, not at that time. The individual operations were entirely left up to the department foreman, and the print only showed at that time the finished size.

Q. Was there at any later date the practice put in of showing the tolerance to be allowed, for grinding, on the print? A. I do not think so.

Q. That was always left, as I understand it, then, to the judgment of the foreman in the department? A. That is right.

Q. What was your practice, then, as to the amount of stock you would leave from the rough-turning, to be taken off in a grinding? A. Well, on the model T cam shaft, we had .020 stock, at least, between the roughed and the finished. And we tried the same thing on the model A, in order to get production, but it was impossible. We figured it took nearly .050 to .060, on the model T, to clean up, on the grinder, and that stock had to be removed on the grinder.

Q. When you said .020 on the model T, did you mean .020, each side, or .020 on the over-all diameter? **(1600)** A. .010 on a side.

Q. .010 on a side? A. Yes.

Q. With the model A, that is .060, or .030 on a side? A. .030 on a side.

Q. Are you sufficiently familiar with the operation of the Walcott machines to state whether or not the job of turning the model A shaft, as compared with the model T shaft, was easier or more difficult? A. The model A was much more difficult, due to the contour of the cam. It was an entirely different contour, and the machine, the lathe, the cam lathe left an excess stock at the very point of the cam on one side. Due to this difficulty, we had to leave sufficient stock on there to clean up the cam itself, below

that little lump left at the point of that cam. That was our chief trouble.

* * * * *

(1606) Q. What was your particular position insofar as the Russian production was concerned? Were you generally in charge of that whole proposition? A. Yes, I had charge of the entire plant. I had the privilege, through Mr. Sorensen of the Ford Motor Company, to pick two selected men from each department or each building, and I could pick them myself, and gather all of the information I wished, including blueprints and tool numbers and all of the information I would like to have, and take it along with me. Among this information there was a complete set of all operations on this job.

Q. That extended not only to the cam shaft, but to each and every part that went into the model A car, from one end to another, **(1607)** is that correct? A. Most of them, whatever I could get; it included a trunk full; it was most of the jobs pertaining to the motor.

Q. How long did you stay in Russia? A. One year.

Q. How large a force of employees did they have at the Russian plant? A. 25,000.

Q. You were placed in charge of seeing to it that they got out the production? A. Yes.

Q. In other words, you must be the "Mr. Sorensen" of the Autostroy plant? A. That is about right.

Q. I hand you another set of similar sheets which refer to the rear brake cam shaft inspection. I hand you these second set of sheets, which I will ask to have marked in evidence as Exhibit 288, and will ask you to tell the Court what they are.

(The set of sheets referred to were thereupon marked Defendant's Exhibit 288 by the reporter.)

A. This is just another form of the same type of information sheets made up for the Russian government.

Q. And I assume that you had a set of sheets of that type for all of the parts to be manufactured, and which was put under your supervision there in Russia? A. Yes.

Q. Can you state the date when these sheets were prepared? A. They were prepared the latter part of 1929 and the early part of 1930.

(1608) Q. The set of sheets which are marked Exhibit 214-A, will you look at them and see if there are any dates on those sheets? A. The dates were never carried on these sheets.

Q. How about the set of sheets which we have marked Exhibit 288? A. No, I do not think so.

Q. The set of sheets marked Exhibit 288—the first sheet contains the date "December 18, 1929"; the second sheet is dated the same; the third sheet is dated "April 15, 1930"; the fourth sheet is dated "April 8, 1930"; the fifth sheet is dated "December 26, 1929"; the next is dated "1/14/30"; the next "1/14/30"; the next one, "1/15/30"; the next, "1/14/30"; the next "12/19/29"; the next "1/14/30"; the next "12/17/29"; the next "1/14/30." Now, can you explain why some of these sheets contain different dates than the others? A. Yes. The time study department has only so many. I think they are covered in these departments in one day. That is the reason the dates varied.

Q. Now, with reference to Exhibit 214, can you state, by reference to the dates on the other sheets forming a part of Exhibit 288, when the sheets in Exhibit 214 were prepared? A. I am sure these sheets were the first ones to be made when the order was given us to make a time study, because I was in charge of this expedition to Russia, and I saw to it that my job was taken care of first. That is the simple reason.

The Master: Who actually prepared this? The Time Study Department?

A. The Time Study Department, yes.

Q. (By Mr. Farley): Is that the particular time study you have reference to when you spoke of having a time study made, and a **(1609)** time study was made, showing 30 shafts an hour? A. Yes.

The Master: The operations shown in the time study department do not commonly list the operations according to production per hour, do they?

A. No, they listed the amount of production per hour, and by the actual time taken by the machine when in operation.

Q. (By Mr. Farley) Are you familiar with the operation sheets of the time study department? A. Well, I don't understand you just right. If they have a different form in the time study, I don't know anything about that.

The Master: As foreman, didn't you have access to certain sheets showing the time it took to perform each operation?

A. Yes, the time study department furnishes our department with a copy of their operation sheet, made up by the time study department.

Q. (By Mr. Farley) I show you Exhibit 7. My question was this, were you familiar with the operation as contained in the sheets of the time study department? I had reference to sheets of the character of Exhibit 7. A. Yes. That is a standard sheet we have in our department.

Q. That is what you had reference to when you said the time study record differed from the record as shown on Exhibit 214, is that right? A. Yes.

Q. Will you refer to the time study sheet, and point out to the Master just what you mean, particularly with reference to the operation of turning the cams? **(1610)** A. This time study sheet is given in minutes, the cost, in minutes, because we never work in dollars and cents; it is given in minutes; whereas, these sheets, Exhibit 214, were made up for the Russian government in that instance, and pieces per hour were given at the request of the Russian representative.

Q. As far as operations are concerned, I might state for your information that this Exhibit 7 happens to be a time study sheet for July 1, 1931, of operations on the model A, when the Pioch machines were in use. Now, insofar as these operations are concerned, I notice you have an operation number on Exhibit 214-A, operation 1, with mill ends, with a No. A-1 Davis mill. What if any operation does that correspond with on the operation sheet Exhibit 7? A. Operation 2, mill both ends to rough length.

Q. Now, I notice operation 13, on Exhibit 214-A, is "turn cam," and it is printed, "milling cam lathe," is that correct? A. No, that is a clerical error. There is

no such thing as milling cam lathe. It is their Melling machine. This would be "Melling."

Q. Is there a similar operation on the operation sheet, Exhibit 7? I think you had better go back again to that page. A. Operation 14?

Q. Operation 14, on the operation sheet, Exhibit 7, corresponds to operation 13 on Exhibit 214, is that correct? A. Yes.

Q. The reason for the difference in number is that No. 2 on Exhibit 7 is similar to No. 1 on Exhibit 214. So that operation 13 on this sheet becomes operation 14 on Exhibit 7? **(1611)** A. That is right.

Q. Now, I call your attention to operation No. 12 on Exhibit 214-A. Will you explain that particular operation to the Court? A. Well, operation 12 had to be put in there to straighten that cam shaft within reason, to enable the machine to take care of the cam in regard to these bearings. The cam is made out of a forging, and these forgings did not come straight enough for the machine to take care of it as they came. They had to be straightened by hand, with a certain limit.

Q. The sheets, Exhibit 214, gave all of the operations required to complete the cam shaft, starting from the beginning in Department 410, to the final operation; and also in addition, the list of operations, which gives the type of machine from which the operation was performed? A. That is right.

Q. Now, with respect to operation 12, state whether or not it says "hand press," and in the "production per hour" it gives "100 pieces per hour"? A. That is right.

Q. Do I understand all of these figures of production per hour, and all of these various machines, are figures which were supplied by the time study department? A. Yes.

Q. As the result of a stop-watch time study? A. Yes, that is right.

The Master: Pardon me. Do you know whether they made special time studies in each department for that purpose, **(1612)** or whether they referred to their regular time studies which were given on each opera-

tion, in minutes, and then deduced the production per hour from that?

A. There is no difference between the pieces per hour, taken off the stop watch, and the minute-cost. The figures are the same. If you multiply the minute cost by the pieces per hour, you will have the same result.

The Master: Now, I am asking you what system they used. Did they go out and make a special study in that department?

A. Yes.

Q. (By Mr. Farley): They did have a special study made of that job? A. Yes.

Q. It was a study made at your request? It was a request by the department to do that? A. Yes.

The Master: What instructions did you give them in reference to that?

A. To have a time study taken, and give the pieces per hour, according to the time study on the job. These sheets were prepared for the Russian government, and it is easier for the Russian to see the pieces per hour, than it is to figure it in minutes and fractions.

Q. (By Mr. Farley): In connection with operation 13, "turn-gang,"—that is on the basis of an operator running how many machines? A. One man runs two machines, and each machine will produce 30 per hour.

Q. How about the straightening operation? **(1613)** A. One machine, with one man, 100 pieces per hour. These time studies are not always for one reading. Several readings are taken by different men. Sometimes we have a good operator on the job, and sometimes a poor operator, and the average is taken on this sheet, to be good and sure that the amount is correct.

Mr. Farley: I think this Exhibit 214 is already in evidence.

Mr. Green: It has not been offered yet.

Mr. Farley: I will now offer it. I think there was some objection.

The Master: Exhibit 214 was offered already.

Mr. Michael: It has been identified, yes.

Mr. Farley: I do not know whether we had that identified by Mr. Klopsic.

Mr. Michael: It was just identified.

Mr. Farley: I think I said at the time I withheld the offer, knowing I was going to produce Mr. Achten, who is very familiar with the whole set of circumstances. I will offer that, and also make an offer of page 1 of Defendant's Exhibit 288; it has no particular relevancy to the subject of this inquiry except as establishing the date when the other record was made.

The Master: If you read into the record all of the other dates, why not leave these out entirely?

Mr. Farley: All right.

The Master: You can simply refer to the fact that some operation sheets have been produced for other parts of the Ford automobile, and the other sheets are added, according to **(1614)** the dates which have already been read into the record.

Mr. Michael: You did not offer the book, Mr. Farley?

Mr. Farley: No. I think he cut them out.

The Court: Do you have any objection to Exhibit 214?

Mr. Michael: Just a minute, your Honor. I may want to cross examine.

Mr. Farley: I think that completes the direct examination, anyhow, of the witness.

(Further discussion between counsel off the record.)

Mr. Michael: Were you through, Mr. Farley?

Mr. Farley: Yes.

Cross Examination by Mr. Michael.

Q. Mr. Achten, you spoke of a straightening operation here, on this Exhibit 214,—item No. 12, isn't it? A. That is right.

Q. What was the purpose of that? A. This cam shaft,—call it Exhibit 30—had to be scraped in three places,—the back cam, and the front cam, and the center cam.

Q. You mean, the back bearing? A. Yes, the bearing.

Q. The back bearing, the front bearing and the center bearing? A. Yes. And if this cam shaft was bent in any way at all, the steady rest would not support this cam, and the forging would break the steady rest.

Q. I notice up here item No. 4, you have apparently some straightening operation 12, to correct the matter. (1615) A. No. On this form we have the straightening operations. When we rough the forge, you can see the mill-ends. This is the rough forge (indicating). You snag this off, but that would not snag the burr off. And on the center ends, we just straighten, then rough-turn.

Q. Now, this is not even rough-turned, is it? A. Different center bearings.

Q. It has to have different center bearings? A. Yes. We have that straightened, when we clean it.

Q. When you turn the center bearing? A. Yes. That is the straightening operation.

Q. No. 4? A. No. 4.

Q. Once you straighten the shaft, and it was straightened as far as the bearings are concerned, the three bearings are in line? A. Yes. The space between the bearings could still be off too much to clean up on rough-turning operations, on a cam lathe. We may straighten that, but that does not mean the cam parts.

Q. You mean the part of the shaft between the center bearing and the end bearing might just be corrected? A. Yes, and that had to be straightened in order to clean up the cams.

Q. Was this type of operation, the straightening operation, No. 12, the same type of straightening as you used, on No. 4? A. Exactly.

Q. What was the operation No. 4, how did you straighten it there? A. We just straightened the rests on the rear and front bearing, (1616) with the press on this center bearing, to straighten the center bearing sufficient so that we could clean it up.

Q. The straightening operation No. 12 was the same sort of straightening? A. The same sort of straightening. They were checked in between 2 and 3 cam and 6 and 7 cam. If you have a piece of chalk here, I will show you.

Q. In this No. 12 straightening operation, instead of checking the ends, you checked the intermediate parts of the shaft, to line them up with the bearings, is that right? A. Yes.

Q. When was that No. 12 straightening started? A. In 1927.

Q. When? A. I would say at the end of June or the first of July, 1927.

Q. That was when you started work on the "A" shaft? A. Yes.

Q. You did not do that on the "T" shaft? A. No, sir.

Q. Why would you do that on the "A" shaft and not on the "T" shaft? A. Because the "T" shaft, it was a smaller cam, in the first place, and the center bearing was not the same size as the others, and we just could not do it on the model A.

Q. You could not do what on the model A? A. Turning that cam without straightening it.

Q. But you could do it on the model T? A. Yes.

Q. In a Walcott lathe? **(1617)** A. Well, we had both. We had the cam shaper and the cam lathe, yes.

Q. Could you turn the "T" shaft in both of those machines without this straightening operation? A. Yes. For one reason, the model A cam shaft is rather heavier than the model T cam shaft. This center bearing on the model T cam shaft is the same size as the new shaft, between cams; and therefore, if this model T cam shaft runs out a certain amount, the steady rest will take care of that without injury. But you could not do that on the model A, because you have a heavy shaft.

Q. Yes, but the straightening operation brings the bearings in line? A. Yes, on the model A.

Q. You had to do some straightening on the model T? A. Yes.

Q. That was intended to line up your bearings? A. Well, that is true. But the relation of the off-center bearing, on the model T, with the parts in between, comes very much closer than the model A ever was.

Q. I don't follow you there. If you are straightening to line up three parts, the center bearings and two end bearings, I do not see why they would not be lined up in each case. A. Yes, but I didn't mean that. I said the center bearing on the model T, after this straightening, that that shaft is more apt to be in line than the model A.

Q. Why? A. Because they were alike. We have turned twice as much stock on this cam as you have on this one (indicating). The head **(1618)** there—

Q. Wait a minute. We are not anywhere near the head, yet. A. I mean in the forgings, when the cam comes out of the forging press, you have a red-hot shaft, and the head draws, and cools off, and this causes the shaft to warp a certain amount in here (indicating).

Q. (By the Master): When you say "in here," you mean the intermediate part of the cam shaft? A. The intermediate part of the cam shaft, in between the two bearings.

Q. (By Mr. Michael): Would the model T shaft warp in between the center and end bearings, for the same reason? A. Yes, but that would not warp so much so that we could not clean up the cams. That is the experience we have had in there in making those.

Q. At any rate, you did not straighten the "T" shaft with either the shaper or the Walcott machine? A. No.

Q. When you started with the Walcott machine, on the "A" shaft, you did straighten them? A. Yes, sir.

* * * * *

(1619) Re-Direct Examination by Mr. Farley.

Q. Do you know when the model T production stopped? A. May 15, 1927. Of course, we made a lot of model T cam shafts after that, for service.

Q. If the records, the time study records show that on the model T production, with the Walcott machines, and other men who had operated the Walcott machines stated, that they did use the straightening operation on the model T shaft, before they put in the Walcott machines, what would you have to say about that? A. No.

Mr. Spohn: If your Honor please, that is a very leading question to ask the witness, and putting the answer in his mouth.

Mr. Farley: The very same question was put, about time studies.

The Master: How positive are you about your statement, or how good is your memory, or your statement, that you did not have a straightening operation on the model T cams?

A. I am positive about that.

(1620) Q. With both the Walcott lathe and the shapers? A. Yes, either one.

The Master: That was true throughout your entire experience?

A. Yes, for two years.

Q. (By Mr. Farley): Did they make the model T for the two years while you were in that department? A. Yes, the production for the model T was still 2,000 a day, after the regular production had stopped.

Q. On the proposition of this straightening operation, your attention was called to operation No. 4, on this Exhibit 214. Now, between operation No. 4, which straightened the shafts, for turning the center bearing, after the center bearing was turned I noticed the next operation was "recess." What is that operation? A. That is cutting a ⅛ groove right alongside of the cam, to stop the cam from turning here along the longitudinal tool, and leave room to get in there and clean it up.

Q. That also faced the side of the cam? A. Yes.

Q. The next operation, No. 7, turn between cams— A. That is in between.

Q. Turning in between cams. Were all of them turned simultaneously? A. With one big tool block. It had six blocks in it.

Q. Would that operation (lathe), tend in any way, if the shaft had not been straight, and made straight by operation No. 4,—would that in any way tend to put it out of shape? A. The part was supported by the steady rest, after the turning **(1621)** there.

Q. The part was supported by the steady rest, after the turning there, due to the removal of the outer skin, and heating; would that in any way tend to make the shaft bowed again? A. I do not think we had this trouble. Well, I want to call your attention to this here, the difference between the model T and the model A; this calls for straightening—

The Master: Operation 4?

A. Operation 4.

The Master: On Exhibit 214?

A. That is right. On the model T, we had that identical same operation—in fact, on the same machine. There

was no difference between the two. We had this straightening for the center bearing. That was the very first operation after it came from the mill. And from there on, the center bearing, the end bearing and the front bearing was turned, and in every operation thereafter, that center bearing was supported by the steady rest.

The Master: Did you have anything to do with the introduction of the straightening operation in the model A shaft?

A. Yes.

The Master: Were you responsible for that?

A. Yes.

The Master: When did you decide to inaugurate that additional straightening operation?

A. It was the very first few weeks, when the job was set up, and tooled up.

Q. (By the Master): When it was still in the experimental stages? **(1622)** A. Yes. We made less than 10 a day.

By the Master:

Q. What was the experience that you had that prompted you to do that straightening operation? A. We gained time, and a lot of expensive repairs, on the turning of the machine, by putting one certain operation on there. That operation was rather expensive, and I had the O. K. to go ahead with it.

Q. What was there about the operation of the machine, before you added the straightening operation, that led you to believe that you would need to straighten these? A. We could not hold the cam in the machine itself, in the cam-turning lathe, because the center bearing went out too much—not the center bearing, but the intermediate part of the cams went out too much. Sometimes the cam would be clean up on top of it. When this tool came here, to clean that cam up, it would leave a black spot on the top of the cam, and parts in between the cam, rough forging marks. It was always on the part between the second and third and fourth and fifth, right in here (indicating). When we straightened this up, our problems were more or less eliminated, as far as the cam turning was concerned.

Q. You said you had two shapers to use in production in the plant, on the model T, right up to the end. A. Yes, until, I think, the Pioch and Melling cam came in, and then they were moved out. That was just after I got out.

Q. Did you use those shapers on the model A shaft?
(1623) A. No, they did not.

* * * * *

(1624) Mr. Farley: Your Honor, at the end of the hearing last night, I spoke to Mr. Spohn and Mr. Michael about, in order to save time, stipulating the testimony of Mr. Payne, on these reports that Mr. Wibel discussed. I assume you are still agreeable to that?

Mr. Spohn: Surely.

Mr. Farley: And, I will dictate a stipulation. You can make whatever corrections or changes you want, if you don't agree with it.

It is stipulated by and between counsel for the parties hereto that if Mr. Payne were called as a witness he would testify that in 1924 he was employed in the purchasing engineering department of the Ford Motor Company as an assistant to Mr. A. M. Wibel, now purchasing director of the Ford Company, and that at Mr. Wibel's request, and acting under his orders, he made an efficiency study of the Walcott cam lathes then in the plant of the Ford Motor Company, and being used there for the turning of the cams of the model T cam shaft;

That he personally prepared the sheets introduced in evidence as Exhibits W-1 to W-14, inclusive, and that the data given on said sheets was obtained by him from actual observation and checking of the machines whose brass-tag numbers are listed on the sheets, the brass-tag numbers being given in the **(1625)** first or left-hand column of each sheet;

That the second column of each sheet, headed, "No. Pieces," lists the actual number of cam shafts turned during the entire operating time of each machine;

That the third column entitled, "Hrs. Run," lists the actual elapsed running time of each machine;

That the figures given in the column entitled, "Mch. Trouble," lists for each machine the number of

hours during which each machine was stopped for machine trouble;

That the figures given in the column entitled, "No Tools," lists the amount of time each machine was stopped because no tools were available to replace tools that were removed for various purposes;

That the data given in the column "No stock" represents the number of hours the machine was stopped because no rough cam shaft forgings were available to be turned;

That the data given in the column entitled, "No oper.," lists the number of hours the machines were stopped because no operator was available to operate the same;

That the information contained in the column entitled "Remarks" sets forth the reasons why machines were stopped for the period of time in the fourth column entitled "Mch. Trouble," machine trouble;

That his period of observation extended from August 11, 1924, to November 1, 1924, and that each of the sheets represents the observation of a full week's work done at the Ford Company.

* * * * *

(1627) FRED HOVIS was thereupon recalled as a witness on behalf of the defendant herein, and having been previously duly sworn, testified further as follows:

RE-DIRECT EXAMINATION by Mr. Farley.

Q. Mr. Hovis, you formerly testified here? A. That is right.

* * * * *

Q. Now, how long have you been in the accounting department at the Rouge plant of the Ford Motor Company? A. Oh, I would say somewhere around 17, 18 years.

Q. Have you been at the Rouge plant during all of that time? A. All of that time, yes.

Q. That would have started your period of employment, then, at the Rouge plant around about 1921 or 1922? A. It was earlier than that. Your first question was how

long had I been in the accounting department, but I worked out there quite a little time before I was transferred to the accounting department.

Q. At the Rouge plant? A. That is right.

(1628) Q. Now, did you have, during the period from 1924, let us say, until 1928 or thereabouts, did you have any Time Study Department at the Rouge plant? A. Not to my knowledge.

Q. Under whose direction or supervision was the first Time Study Department at the Rouge plant inaugurated; who was first put in charge of the Time Study Department? A. Klopsic.

Q. Klopsic. And, prior to Klopsic, as far as you are aware, there was no Time Study Department over there at the Rouge, is that the idea? A. Not a regular Time Study Department.

Q. Now, I show you three sheets, which are marked Exhibits 16, 17 and Exhibit 281. I will ask you if you ever saw those sheets before (handing documents to witness). A. No, I haven't.

Q. Do you recognize those sheets as sheets employed or used at the Ford Company? A. Yes.

Q. Can you state from an inspection of them just what the sheets are? A. Well, I would say they are a list of operations with the Department in which the operations are performed showing at the left; there is a minute cost shown for each operation, and total minute cost. And, there are pencil figures there which were, no doubt, used for inventory purposes.

Q. Do those pencilled notations mean anything to you as for the department in which those sheets were used, and the purpose for which they were used? **(1629)** A. Yes. They were computations made on these sheets used in pricing inventory.

Q. Did you ever do any work of that type yourself? A. Yes.

Q. And, would any other department at the Ford Company, to your knowledge, have the information necessary for putting in the pencilled figures other than the accounting department? A. You mean the minute cost?

Q. I mean the pencilled figures. A. No.

Q. Take the pencilled figures at the extreme right-hand margin of the sheet. A. The accounting department

is the only department that would have cost figures, which those represent.

Q. Did you ever prepare any costs during this period, say, from 1925 to 1927 by the use of sheets similar to these, yourself? A. We have prorated cost, yes, by operations. Actual costs, of course, are figured on the regular cost card. These would be used merely to prorate that cost over operations.

Q. My question is, did you ever do any of that sort of work personally? A. Yes, sir.

Q. During this period of time, that is, from 1925 to 1928? A. I would say so; yes.

Q. As I understand it, you just testified that these pencilled figures were for the purpose of obtaining inventory prices for work in process? A. That is right.

Q. Did you know anything about the system, if it can be called such, (1630) that was in vogue at the Rouge plant for obtaining the minute costs as given in the typewritten column at the right of each of these sheets? A. Yes.

Q. Will you explain what it was, if you know? A. Well, we had no stop-watch time study at that time at the Rouge plant, and any information that would be arrived at for getting minute costs by operations would be merely by consulting someone actually performing the operations, or the foreman in charge.

Q. Now, for the purpose of obtaining actual costs to the Ford Company of a cam shaft, as these cards refer to cam shafts, do you in your department, or did you at any time in your department, use these operation sheets, Exhibits 16, 17 and Exhibit 281? A. To arrive at a cost?

Q. To arrive at an actual cost of a cam shaft. A. No, sir.

Q. What do you use for that purpose? A. Total production; total actual payroll hours.

Q. And that information you have on the cost summary cards which have been introduced in evidence here; is that correct? A. That is right.

Q. The cost summary cards being marked Exhibits D, and E-1 on to—I think Exhibit F-13 is the last. Now, are you familiar with the time study operation sheets of the Ford Company? A. Yes, sir.

Q. Do you know a man by the name of Victor Marentette? A. Yes, sir.

(1631) Q. Who is Victor Marentette? A. He is an employee of the Time Study Department at the present time working for Klopsic.

Q. I show you photostatic copy of a sheet marked Exhibit 14, and dated 10/8/24. Can you state what that is (handing document to witness)? A. Well, that is an operation sheet, or a time study sheet, but I can't tell from looking at this sheet just how these minute costs were arrived at.

Q. I call your attention to the initials "V. F. M." A. I would say that was Victor Marentette.

Q. And would the inclusion of those initials on that sheet enable you, as an accountant of the Ford Company, to recognize that as a stop-watch time study made by Marentette? A. I would say that it was; yes.

Q. Now, I call your attention to Exhibit M, and ask you if you recognize that as a— (handing document to witness). A. I would say that was a time study.

Q. I wonder if you would be good enough to compare the operations listed in Department 410 on these two sheets; first, would you take sheet, Exhibit 14, and—or, take Exhibit M, first, and state how many operations are listed on that sheet in Department 410. I just mean the total number of operations. The number of the operations is given in the— A. 45.

Q. Yes. —given in the column at the right of the sheet. Now, will you look at Exhibit 14, and see how many operations are listed? A. 46.

(1632) Q. Can you, by inspection of those two sheets, if you will look at them, find where the extra operation is? A. (Examining documents.) That is pretty hard; you see, they are not lined up the same at all; that is by number.

Q. Well, suppose you start on the first sheet of each, take your first operation in Department 410. A. Yes.

Q. Which is your first operation in Department 410 on Exhibit M? A. Operation 3 in both places is the "center both ends."

Q. Start there— A. Operation 4 is "rough straighten"; that is the same in both places. 5 is "rough turn 'C' center bearing"; that is the same in both places. 6 is "rough turn between cams."

Q. How about that? A. The same in both places. 7 is "straddle"; that is the same in both places. 8 is

"rough turn gear post"; that is the same. 9 is "drill 'L' hole"; that is the same. 10 is "turn end bearings." 11 is "rough grind center bearing." 12 is "shape cams" on Exhibit M; "straighten" on whatever this exhibit is.

Q. Exhibit 14. A. Exhibit 14.

Q. Is there any difference there? A. Yes. They are not the same. One is "shape cams."

Q. How about the next operation on Exhibit M? A. "Cyanide."

Q. Operation 12? A. Operation 12 is "shape cams."

Q. How about 13 on Exhibit 14? A. That is "turn cam lathe."

(1633) Q. Do you know whether or not the operation of "shape cams" and "turn cam lathes," is there any pertinence of those two operations, one to the other? A. Well, they sound as if they probably mean the same thing. I am not positive, of course.

Q. If we assume that the operation "turn cam lathes" and "shape cams" is for the same purpose of rough finishing the cams of the cam shaft, what do you have to say, then, as to the presence or absence of any additional operation? A. The additional operation is "straighten" on this exhibit here.

Q. Now, do you notice the time for the straightening operation on Exhibit 14? A. Half a minute; yes.

Q. Let me ask, Mr. Hovis, if your department in figuring costs gives any information at any particular time, stated intervals, or otherwise, to the executives of the company concerning costs of any particular parts that go into the car? A. Do you mean costs in the term of minutes?

Q. No, I mean costs in the term of dollars and cents. I mean, let us take, as we are talking about cam shafts here, assume the proposition that Mr. Martindale, or whoever handles your department, does he at any time give to the executives of the company, Mr. Wibel or Mr. Crawford, Mr. Sorensen, Martin, or any of them, the figures of what it is costing the company to produce a cam shaft? A. Yes, if they should ask for it. He doesn't—as a regular thing he just doesn't supply that information. There are too many parts. He supplies them with the total automobile cost by different types of models. If something should come up **(1634)** that they would be interested

in any particular part, and they wanted the cost of them, he would supply them with the cost.

Q. Now, I would like you to state whether the addition of a half minute of cost, as indicated by these two operation sheets, is a matter which would or would not come to the attention of the executives of the Ford Company? A. Yes, if there is an increase, it would. It would increase the cost, it would eventually increase the car, the cost of the car, and when there is an increase in the cost of the car, it has to be analyzed. They ask those questions, of course, where the increases are.

Q. What proportionate part of the cost of an entire automobile at the Ford Company would the half minute addition for straightening represent? A. Practically nothing.

Q. If, however, there were—let us assume, take your minute cost on the preparation of one of these cam shafts, we will take for round figures, to be, say, $2. Now, if there was a very major variation in that cost, as your department figures these costs, and it went up, we will say, to $4 rather suddenly, would that be a matter that you would be likely to call to the attention of the executives? A. Absolutely; sure.

Q. But, if the matter was in your charge, would you say whether or not you would get in touch with the executives concerning a half minute increase in cost on a part? A. Absolutely not.

Mr. Farley: I think that is all.

(1635) The Master: Is your department furnished with copies of all time studies made by the Time Study Department to date, to your knowledge?

A. Yes, sir.

The Master: How long has that been true?

A. Oh, I couldn't tell you exactly.

The Master: You don't know whether it has been true since the Time Study Department was organized or not?

A. I believe it has.

The Master: What does your department use the time study sheets for?

A. Oh, just for information for cost men to refer to. The actual time studies wouldn't be used in computing cost at any time unless there was a cost necessary to be compiled that would show operation cost. As far as compiling the cost is concerned, we could compile the cost, build up the cost of the automobile, without time studies.

The Master: Do you use the time studies for the same purpose for which these former studies made by your department were used?

A. In addition to that, these time studies are used by the foremen in the plant as a guide.

The Master: I am restricting it to your department. What does your department use it for?

A. I would say the only thing they use them in the cost department for would be to prorate cost for operations to price a particular part that may be sold or supplied, or fabricated in an unfinished state, or for pricing inventory in process.

The Master: And for no other purposes?

(1636) A. Time studies for operations on assemblies would be used for other purposes.

Q. (By Mr. Farley) That is a complete assembly? A. Yes. Because an assembly has to be built up with minor parts and minor assemblies, and this operation sheet would show, for instance, in the assembly how many screws or bolts were used, and how many parts would be required, for instance.

Q. When you say "this operation sheet," you are referring to Exhibit M? A. No, I am referring to an operation sheet for an assembly.

RE-CROSS EXAMINATION by Mr. Spohn.

Q. Mr. Hovis, Exhibit 281, on the top of it, has this language in parentheses: "(One used in T-5949 assy)." What does that mean? A. One cam shaft is used in this assembly. This, no doubt, is a motor assembly. I am not positive just what that represents now.

Q. What does that language mean as applied to this Exhibit 281 on which these minute costs are set forth? A. That means one part, one T-410 cam shaft is used in this assembly.

Q. What is an assembly T-5949? What does that mean? A. I am not sure; but I believe it represents an engine assembly. That is where the cam would be used.

Q. And, doesn't that language rather mean that the information contained on Exhibit 281 here may be used to price that cam shaft used in that assembly? **(1637)** A. You mean the total cost? You mean these minutes shown here?

Q. Yes. A. No. That doesn't mean that the minutes to be used in compiling the cost.

Q. Supposing that you are going into the change of your cam shaft, and you are going to add new operations. A. That is right.

Q. Your cost summary cards do not show cost by operations, do they? A. No, they don't.

Q. Now, get back to the time from 1924 to 1928, or thereabouts, when you say you had no time studies. A. Yes.

Q. Go back to the time you put out the model A car. A. Yes.

Q. How would you then determine, if you did determine, the cost of the new A cam shaft? A. By taking the total production and the total hours, regardless of operations.

Q. Didn't you make a study of that cost before you ever put them into production to get an estimated cost of that for your own purposes? A. Well, I couldn't say whether they do or not.

Q. Didn't you testify, or did I understand you incorrectly, when you said that these operation sheets of the type of Exhibit 281 are used sometimes in assembling costs when you want to find out and prorate operations? A. No, I say the operations are used for a build-up assembly of a cost; it is just for an assembly; not a part.

(1638) Q. What do you mean by an assembly? A. Take a door assembly. You would write up an operation sheet like this for a door assembly. You would have the outside panel, and the door lock, and the two pillars, and the header and striker plates, and so forth; so many screws, upholstering, possibly, window glass, and so forth. These operations would show how many of these screws are used; would show the symbol number of the glass, the symbol number of the pillar, and so forth. Now, on another set,

on a regular cost build-up set, we would have this assembly number, hours, and all the parts that go in there, and the names and the quantity required, but no minutes.

Q. Now, going back to the time you went on the production of the "A" motor, that assembly would include a cam shaft, wouldn't it? A. That is right.

Q. And, in this assembly cost you are speaking of, you would have a cam shaft set down there, wouldn't you? A. That is right.

Q. And, would that be done before or after production actually started, that assembly cost? A. I would say it would be done after production actually started.

Q. Wouldn't you have any idea what that car was going to cost you before you would build it? A. Not necessarily. Somebody may make an estimate based on, possibly, a model T, based on some—if somebody just wanted a rough estimate. But, we often figure estimates probably based on past experience, or just an estimate in the whole for somebody's information; but, an actual cost isn't compiled **(1639)** until you actually start producing the part.

Q. And, you have no estimate yourself even before the part is built? A. As I say, they probably have an estimated cost based on past experience in building a similar part.

Q. Then, these assembly sheets you refer to aren't cost studies at all? A. What do you mean?

Q. All they are is a list of operations, but they don't reflect any cost? A. Sure they do. The amount required for each part, you can't figure the cost in until we get the cost. For instance, in an assembly we have all the parts that go into the assembly of the motor. Included in there is one cam shaft. It is listed here. After we have completed a month in which this assembly was produced, and also the cam shaft, we assemble the cam shaft in there at the actual cost of the cam shaft based on total production and total hours; not operations. We don't use time studies at any time to compile a cost.

Q. So that your time studies, then, are never tied in with your cost department at all, are they, for the purpose of defining cost? A. Not for the purpose of defining cost, no. They are tied in with the cost department insofar as now they take stop-watch time studies in regard to the hours that are consumed.

Q. That is all this Exhibit 281, with the pencil figures on it, was used for, as I understand your testimony; if some part, or unfinished part, were sold, this Exhibit 281 was used to determine the cost, is that right? **(1640)** A. Something similar to that.

Mr. Farley: May I have that question please, and answer?

(Question and answer read by the reporter.)

Q. (By Mr. Spohn): And, Exhibit 281 was used, as you testified, for the purpose of preparing your inventories? A. Yes, that is right.

Q. And those inventories are regularly carried as part of the Ford records, are they not? A. That is right.

Q. And form the basis—it is one of the elements they must take into consideration in regularly computing the income of the defendant company? A. That is right. I want it understood that these minute costs are used as a basis of proration for actual cost. These minutes, as shown in here, weren't used to compile cost in the beginning, any more than time studies are today, stop-watch time studies.

Q. You wouldn't have a cost summary, would you, for an unfinished part? You only get your cost when your part is finished? A. That is right.

Q. So, if you did not use something like Exhibit 281, you could never price an unfinished part in your cam shaft department? A. That is right. That is why we used it.

Q. So, if it is necessary to have goods in process in your inventory, you could only use Exhibit 281 at the day of its date for the purpose of finding that? A. That is right.

Q. And those inventories, of course, are used on your Federal income tax returns? A. Yes, sir.

(1641) Q. And, that pricing was there used on that inventory of goods in process? A. Yes.

Q. And, wherever the defendant company had to determine a cost of a cam shaft that was unfinished for any purpose whatsoever, you had to rely on Exhibit 281 as of the day of its date to get that? A. That is right.

Q. And, you did that? A. That is right. We did that because costs were not compiled, actual costs by operations.

Q. Now, Mr. Hovis, as I understood your testimony, you say there was no regular Time Study Department at the Rouge plant from 1924 to 1928? A. I don't know the exact date that Klopsic was transferred out from Highland Park, and when he was, why, they established a regular Time Study Department, but I couldn't say the exact date that he came out.

Q. In any event, then, from 1924 up to the date Mr. Klopsic came over to the Rouge plant to put in the Time Study Department, there was none in the Rouge plant? A. No; not a stop-watch Time Study Department.

Q. Was there any kind, whether you call it stop-watch Time Study Department or not? Was there any kind of a Time Study Department over there? A. No.

Q. They had one at the Highland Park plant, though, did they not? A. I didn't work at the Highland Park plant, and I wouldn't want to say for sure, but I believe they did.

(1642) Q. Well, do you know? A. I believe that was Mr. Klopsic's work out there, and when he was transferred out here, he carried on with the same work.

Q. Do you know— A. (Interrupting) No, I am not positive.

Q. Just a moment. Do you know whether or not any actual time studies were made at the Rouge plant from 1924 up to the time Mr. Klopsic came, whether they had any regular department or not? A. No, they didn't.

Q. Do you know that of your own knowledge? A. Well, I know that the Time Study Department always has come under the accounting department head, and I know that minute costs or time studies that were taken such as of this particular Exhibit 16 were taken by cost clerks and employees of the cost department, by going out, as I testified before, and consulting the machine operators, or the foremen in the department.

Q. Now, you didn't know very much about Mr. Klopsic's department over at the Highland Park plant here? A. No.

Q. Before he came over to the Rouge plant; did you? A. I did not know much about it, no.

Q. As far as your information goes, Mr. Klopsic may have come over to the Rouge plant and made time studies, even though his department was over in Highland Park?

A. Well, it is possible, but not probable, I would say, because I am in the accounting department myself, and working on cost continually, why, the same as if he would have been out making **(1643)** time studies for the accounting department, why, I would have known something about it. It is possible, though.

The Master: Didn't you ever consider the possibility of using the time studies made by Klopsic in the Highland Park plant instead of inquiring directly of the foremen and workmen on the various machines as to the time for operations?

A. You mean didn't we consider using time studies made by Klopsic at Highland Park at the Rouge plant?

The Master: Yes. Your manufacturing processes were very similar.

A. Very similar, but they were entirely two different plants; kept records almost separate, you might say, two accounting departments, two cost departments, under different heads. Carnegie was at one time at the head of the accounting and cost department at Highland Park, and a man by the name of Brubaker was in charge of the cost department at the Rouge plant, and there never was any occasion where, for instance, Brubaker would go to Carnegie and ask him for a time study to use at the Rouge plant.

Mr. Spohn: That is all, Mr. Farley.
Mr. Farley: Just a minute, Mr. Hovis.

Re-Direct Examination by Mr. Farley.

Q. Do you happen to know who actually determines the price at which a new car will be sold in the Ford Company? What particular official, or just how is that— A. Sets the selling price, the list price?

Q. Yes. A. I would say Mr. Crawford.

(1644) Q. And just before, for example, you came out with the last models, the last line, do you know anything about how Mr. Crawford went about determining those prices? A. No, I don't. I know we compiled a lot of information, the cost department. As I say, when a new model comes out, the way models change now, for instance, a great many parts are the same. If there is a change in

design, why, it is estimated largely on the basis of a part similar. There isn't anything else to base an estimate on.

Q. During the period immediately prior to announcing the price on the new line, the head of your department, Mr. Martindale, gets in consultation, and he and Mr. Crawford spend quite a long period of time? A. That is right.

The Master: What is Crawford's position?

Mr. Farley: He is assistant to the president.

Q. (By Mr. Farley) And, prior to these meetings, which you know Crawford and Mr. Martindale are going to have, you know the men in your department are very busy engaged compiling what data you can, and turning it over to Mr. Martindale? A. That is right.

Q. In fact, you work on that yourself, don't you? A. Occasionally. On the overhead end of it.

Q. Now, just one other question, in view of the cross examination about Exhibit 16. Do you know any information that there was in the Ford Company by means of which you could get or establish **(1645)** the cost of any particular operation? Do you remember that question? A. Yes.

Q. I would like to ask this, first, Mr. Hovis. You know the purpose of these proceedings here? That is, you prepared a statement? A. That is right.

Q. And, you know the importance, we will say, of establishing as accurately as possible the cost of this one particular operation? A. Yes, sir.

Q. The turning of the cams of the cam shaft? A. Yes, sir.

Q. What would you say as to whether or not you would use, as an accountant, the information contained on any of these sheets, Exhibits 16, 17 and Exhibit 281, for the purpose of determining or establishing that cost? A. I would say that they were not, by any means, accurate enough to be used to establish an actual cost on that particular operation, or any other operation.

Q. And, if you wanted to establish that cost as accurately as possible, how would you determine it? A. I would have an accurate time study taken; stop-watch time study taken when production is normal.

Q. And, if you are able to find records which were established to be actual time study operation sheets, would

you use those to compile the cost in preference to the Exhibit 281, which is a duplicate of Exhibit 15, attached to Exhibit "C," and Exhibits 16 or 17? **(1646)** A. Use the actual time study in preference to Exhibits 16 or 17.

Mr. Farley: That is all.

The Master: You said you personally made some of these, or compiled some of these operation sheets?

A. That is right. I wouldn't say I compiled these exact sheets, here.

The Master: Do you recall what parts, or some of the parts for which you compiled similar sheets?

A. No, I don't; not at this time.

The Master: Do you recall the method you used in compiling such sheets?

A. The method we used was by taking the time study as shown here, which would total down to a certain number of minutes, and comparing those minutes with the actual minutes for the particular month used, and arriving at a percentage there for different methods used at different times.

The Master: Did you ever go out for the first time before there ever was any previous time study in the files to determine the time it took to perform the operations of making one part?

A. No, I never did that myself.

The Master: You had never had occasion to do that?

A. I never went out and actually contacted the foremen or the men, to arrive at these minutes.

Q. (By Mr. Farley) You never did that personally? A. No, I never did that personally.

Q. Let me ask you this, so far as these computations in pencil are concerned, which you testified was for the purpose of inventorying work in process, have you found that method **(1647)** sufficiently accurate for your inventory purposes? A. Yes; it always has been.

The Master: Do you sell much work in process or many parts that are not finished parts?

A. No, we don't.

The Master: When do you have occasion to sell them?

A. Very rarely do we sell an unfinished part. I can't think right now of any time that we would have occasion, but I believe that once in a while for certain occasions that we may take a part and have it partly finished, more for samples than anything else, and ship it over to Ford Motor Company, Canada, which will get those parts in the same way. Of course, we have to price them, though, on account of the duty, and so forth, but there would be just a few of each item. We sell a large quantity of bar steel billets, and so forth.

Q. (By Mr. Farley) But, you have a regular cost? A. We have a regular cost for that. That doesn't have to be prorated by any operation sheet.

Q. Then, for the few parts you do send out, let us assume, getting back again to the particular part we have under discussion here, let us assume you are going to send over to Ford Motor Company, of Canada, a partially finished cam shaft such as is shown in Exhibit 29, and you would send very few of them, let us say, a half dozen, or three or four, would the approximation of cost such as you have on Exhibit 16 be sufficiently accurate for that purpose? A. I believe so, yes, the same as pricing the inventory.

Q. Do you know of any instance in your own personal knowledge, **(1648)** Mr. Hovis, where your cost department, prior to the situation which has arisen in this case, has ever found it necessary to get an actual cost on a single operation of 45 or 50 that go into making any particular part? A. No, I don't know of any case where it has been necessary to get an actual accurate operation cost at any time.

Q. In the 18 or 20 years you have been in the Ford Company? A. That is right.

Mr. Farley: That is all.

Re-Cross Examination by Mr. Spohn.

Q. Now, Mr. Hovis, I understand your testimony to be that you have never prepared, yourself, the data from which Exhibits 281, 16 and 17 are examples by going out into the shop yourself and talking to the foremen, or somebody else under you? A. That is right.

Q. Then, how do you know those aren't right? A. I didn't say they are not right by any means. I say they are estimates. Any time you go out and talk—it is just reasonable to assume this, any time you go out and talk to an individual operator of a machine, and say how many of these can you make in an hour, and he gives you this information, that that isn't as accurate as when you go out and take a stop-watch and get off at a distance and watch this man working at normal speed.

Q. Now, Mr. Hovis, you know, do you not, that during some of these years of this accounting, a stop-watch time study was not made for nine months at a time? A. You say I know that? No.

(1649) Q. Do you know that? A. No, I never took any stop-watch time studies.

Q. You don't know anything about them? A. I never took any stop-watch time studies. I wouldn't say. I don't know anything about them; no.

Q. If the fact is that you have some of the periods during this accounting, even after a time study department was established, nine months were allowed to elapse before a new time study was made— A. Yes.

Q. —and, in the meanwhile, operation sheets, like Exhibits 16, 17 and 281 were prepared from talking with the foremen, which is more liable to be more accurate as of the day of the date that you want to determine the total minutes in those operations? A. I would say that the mere fact that no actual stop-watch time study was taken for nine months wouldn't mean by any means that the last time study that was taken wasn't accurate, because when there is a change, when there is any change of any kind that is going to change the minutes, the time study department is notified and a new sheet is written up. The fact there hasn't been any change would lead you to believe that it is accurate. There has been no change.

Q. So, you want to be understood as testifying, then, that a time study taken in 1924, if there were no changes in operations, would show the same amount of time consumed in the operation as it would, say, in 1939? A. No. 1924 to 1939—

Q. What is the difference between nine months and fifteen years, if there is no change in operations? **(1650)** A. Difference in the parts, I assume.

Q. I said assume no change in operations. A. I don't believe we have a condition where the same time study would be used that long from 1924 to 1929. It is possible—

Mr. Farley: 1939.

A. 1939, yes. They get around and take time studies more often than that.

Q. (By Mr. Spohn) Mr. Hovis, you do not know of your own knowledge what information was given to the persons who compiled the minute costs set forth on Exhibits 281, 16 and 17? A. No, I do not.

Q. And for all you know, the information may have been accurately given by the foreman in these departments, may it not? A. No, I—

Q. For all you know about it? A. Just a minute, now. I just don't want to say offhand for all I know if that is not so. If I don't think so, I don't want to say that. The fact these minutes totalled down—I haven't had a chance to check it—if these minutes total down to a figure less or more than the actual minutes for the part, then I wouldn't say that for all I know these are accurate. I would say that they are not accurate.

Q. Which is accurate, the actual— A. The accurate is the actual production, and the actual hours that have been paid for. That is the accurate figure. That is the actual minute cost. If these total down to a different figure, I wouldn't say these are correct.

Q. Let me understand your testimony correctly. Then, if the Ford Motor Company records that are here in evidence show **(1651)** that the actual time paid for on these shop records differs from the time study, then the time study is wrong? A. No, I wouldn't say that.

Q. Are the production records more accurate than the time studies, then? A. The total minutes.

Q. The total minutes are? A. The total minutes can't help but be accurate.

Q. Mr. Hovis, I show you now Exhibit H-8, production record for the month of July, 1929. I call your attention on the top of that production sheet in parenthesis is time study 37.6722 (handing document to witness)? A. That is right.

Q. And, on the bottom of the sheet, as I understand it, there is an actual figure of—what is that? A. 41.9199, I think it is.

Q. Is that 41.9199? A. That is right.

Q. And, is that 41.9199 the actual average for the month? A. That is the actual average for the month, yes.

Q. And, you will notice that those minute costs daily figures vary considerably in that exhibit? A. Yes, they would, sure.

Q. Which is more correct, the time study or these production figures, minute costs? A. For this particular month, this is the actual figure. These hours represent money that has been paid for, and it is the actual production. Now, the reason that this time study is put on here, on this same sheet, is for the foreman's information. **(1652)** When he looks at this sheet and sees that his minutes are 41.91, and an honest time study has been taken of 37.67, he knows where to concentrate his time, and make an attempt to bring this 41 minutes down to the 37.

Q. Well, when you say this figure is— A. 41.9199.

Q. Now, turn to Exhibit H-14, where you have the same time study figure for the month of January, 1930, of 37.6722, and you have an actual production figure of minutes of 33.8618; is that right? A. That is right.

Q. So that there you have an actual cost below the time study record? A. That is a different part. One is A-6250, and one is A-6250-A-1.

Q. Let us get the same part, then. On Exhibit H-12, it is the same part, isn't it, A-6250? A. It looks to be.

Q. And there you have a minute cost of 37.3938 actual, is that right? A. Yes.

Q. And that is below the time study— A. Yes.

Q. —that is below the time study of 37.6722? A. That is right.

Q. Which is more accurate there? A. Well, just as I say, this is the actual. There isn't any more accurate than an actual.

Q. Now, then, the actual represents the paid-for labor, does it not? **(1653)** A. That is right.

Q. Isn't the statement of a foreman as to his production, when he has before him his blackboards to keep track of production, why shouldn't that be just as accurate as a time study? A. Lot of reasons. It is just human nature for a foreman, or a man working on the job, to be a little off on his figures. That is all. It is just natural that a man's memory, and so forth, isn't as good as an actual stop-watch.

Q. Well, you used to have blackboards in this department, didn't they, for actual production? A. I am sure I couldn't tell you. I would imagine they would have, yes. I have seen blackboards in foremen's departments, and so forth.

Q. If they have blackboards on which they recorded every shaft that was turned during a given shift,— A. Yes.

Q. —that would be accurate, wouldn't it? Should be? A. As far as production is concerned?

Q. Yes. A. As far as production is concerned, yes. No doubt the production would be the same. It is the hours that make the difference; the time that they tell you they do these things in.

Q. So that, if in this turning department they actually had blackboards, and the foreman, when he gave these figures to the man who made up Exhibits 16, 17 and 281, the foreman has pretty good information, hasn't he? A. He has as far as production is concerned, but where is the foreman going to get the hours applied against this particular **(1654)** operation unless he estimates it?

Q. He has the number of hours in the shift? A. But they charge the hours against the symbol number; not against the operation. Just like shown on this Exhibit 202 here, if he is going to tell at the end of the day, or when somebody comes and asks him how much time has been spent on a particular operation, he is going to try to estimate it.

Q. Do you know anything about the blackboard system? A. I know they had blackboards for production. I don't remember seeing any hours on them.

Q. That is all you saw, blackboards for production? A. That is right.

Mr. Spohn: That is all.

RE-DIRECT EXAMINATION by Mr. Farley.

Q. I show you Exhibit H-1, that is the Form 2202-B you were just referring to. A. 2202, yes.

Q. That particular H-1 exhibit is for a part T-410, and it is dated November, 1927, is that right? A. That is right.

Q. And it gives an average minute cost for the department for the entire month of November, does it not? A. That is right.

Q. And, it gives an average minute cost of 35.4595? A. That is right.

Q. Now, will you compare that with Exhibit 281. What is the total **(1655)** minute cost on Exhibit 281 for the part T-410? A. It is 23.051.

Q. What is the total minute cost as shown by the actual production figures? A. 35.4595.

Q. And, the two times there are within one month of each other; this is December 21, 1927, and this is, as I understand, the system for the actual cost of producing the "T" shafts in that department during the month and at the end of the month of November, 1927? A. That is right.

Q. Now, having in mind your reply to Mr. Spohn's question, if the total minutes on Exhibit 281 were out with the actual cost, what is the situation with respect to the total minutes as shown on Exhibit 281, and the actual production figures; do they conform, or is one out, or what? A. I would say that the actual, of course, shows the larger number of minutes.

Q. The actual shows a total of 35 minutes, and the estimated Exhibit 281 shows 12 minutes less time for the entire operation? A. That is right.

RE-CROSS EXAMINATION by Mr. Spohn.

Q. Mr. Hovis, on this same Exhibit H-1, you will notice up at the right you have "Last month and best month"; do you notice that? A. That is right.

Q. And, the best month of the minutes of operation total was **(1656)** 18.8704, do you see that? A. Yes.

Q. Which is lower than the 23.051 in Exhibit 281? A. That is right.

Q. So that the foreman's figures may be an average figure, may they not, to reflect the best with the worst? A. It might happen to work out that way; yes.

Mr. Spohn: That is all.

The Master: That is all.

(Witness excused.)

Mr. Spohn: Now, will you call Mr. Franklin?

Mr. Farley: Yes.

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